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UNITED STATES NATIONAL MUSEUM

BULLETIN 202

FISHES OF THE MARSHALL AND MARIANAS ISLANDS

BY

LEONARD P. SCHULTZ AND COLLABORATORS:
LOREN P. WOODS AND ERNEST A. LACHNER

VOLUME 3

Families Kraemeriidae through Antennariidae

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This work forms number 202, volume 3 of the *Bulletin* series.

FRANK A. TAYLOR
Director, United States National Museum

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INTRODUCTION

By Leonard P. Schultz

This is the third and final volume of U.S. National Museum Bulletin 202, "Fishes of the Marshall and Marianas Islands." The first volume was published on December 15, 1953, and the second on May 11, 1960.

A list of fish collecting stations, maps, and other information pertinent to the use of volume 3 were published in volume 1.

The manuscripts for volumes 2 and 3 were completed in 1954, except for the family Gobiidae, including its various subfamilies of eleotriids and gobiids. These are under study by Dr. Ernest A. Lachner, who will report on them in a separate publication.

FISHES OF THE MARSHALL AND MARIANAS ISLANDS
Volume 3

Order PERCOMORPHIDA
Suborder GOBIINA
Superfamily GOBIOIDEA

By LEONARD P. SCHULTZ

Authors who have studied the numerous genera of gobiid fishes indicate that this group contains an assemblage of rather diverse genera (Herre, Philippine Journ. Sci., vol. 82, No. 4, pp. 345–347, 1954). The Gobiidae may be recognized by about 5 or 6 feeble dorsal spines, then a slightly wider space, followed by the second dorsal with a single feeble spine and about 7 to 32 soft rays. The anal fin origin is opposite the second dorsal and is composed of a single feeble spine and about 7 to 32 rays. The pelvics have 1 spine and 3 to 5 soft rays inserted under or nearly under the pectoral fin base. One outstanding characteristic is that the inner rays of the pelvics are the longest and are sometimes connected by a membrane running along their inner edges. In certain intermediate genera between the Gobiinae and Eleotrinae, it is difficult to distinguish the presence or absence of a connecting membrane between inner pelvic rays. An air bladder is present in most gobiids; there is no lateral line.

A study of the Microdesmidae and Kraemeriidae reveals that these two families share most of the above characters, e.g., no lateral line, pelvics I, 3 to 5, inner rays longest, forming or not forming a cuplike disk, pelvic insertion under base of pectorals or nearly so, dorsal fin composed of feeble spines anteriorly and soft rays posteriorly, anal origin usually just behind anus, composed of one or possibly two feeble spines anteriorly, followed by soft rays; air bladder usually present; gill cleft behind fourth arch not restricted.

An examination of the genera and species usually referred to the subfamily Trypauchenina under the family Taenioididae indicates relationship with the Microdesmidae. The character that distinguishes this subfamily among all Gobiina is the pit at the upper margin of the opercle that opens to a cavity which is separate from the gill cavity. At least two species referable to the genus *Try-*

pauchenichthys have the pelvic fins separate but close together. The fishes of this relationship appear to be intermediate between the family Taenioididae and the family Microdesmidae.

After the preparation of this section in early 1954, Dr. William Gosline during his visit to the National Museum in September 1954, discussed with me the relationships of *Kraemeria* and *Microdesmus* since both of us intended to publish on the relationship of *Paragobioides* to the Microdesmidae, a problem first suggested by Fowler (1949, p. 152). I was glad to see Goslines' paper, "The osteology and relationship of certain gobioid fishes, with particular reference to the genera *Kraemeria* and *Microdesmus*," appear in Pacific Science (vol. 9, pp. 158–170, figs. 1–7, 1955). However, since I have had to include some of the genera not covered in his osteological study, and since some of my observations on characters do not agree fully with his, I am leaving this section as it was originally prepared.

Through the courtesy of the Leiden Museum, I have examined the holotype (Cat. no. 4800) of *Pholidichthys leucotaenia* Bleeker. This unique species was placed by de Beaufort (*in* de Beaufort and Chapman, Fishes of the Indo-Australian Archipelago, vol. 9 p. 446, 1951), along with the genus *Gunnellichthys*, in a separate family, Pholidichthyidae, under the Order Blennioidea. I have referred this genus to the family Microdesmidae. I note the following corrections for the illustration of *P. leucotaenia* by de Beaufort and Chapman (fig. 85, p. 448): Dorsal origin is half eye diameter in front of a vertical line through rear edge of head; head is too short, the length of head is contained 2 times in distance from snout tip to anal origin; a vertical line through rear edge of maxillary passes through rear edge of pupil, eye diameter equal to snout and contained 3 times in postorbital length of head. Measurements made on the type and expressed in thousandths of the standard length of 83.4 mm. are as follows: Length of head 198; depth 108; diameter of eye 38; length of snout 38; bony interorbital space 26; snout tip to dorsal origin 180; snout tip to anal origin 396; length of longest caudal ray 76; tip of snout to rear edge of maxillary 62.

The unique dentition of *Pholidichthys*, conical teeth in 4 overlapping rows in both jaws, not correctly illustrated by de Beaufort and Chapman (fig. 85, 1951), has been diagrammatically drawn by me (fig. 133). Provisionally, I do not consider the family Pholidichthyidae as closely related to the Blenniina; there are no spines in the median fins and the pelvic fins, resembling those of eleotrids, are located under the pectoral fin base and not in front as in blennioid fishes. This aberrant family I tentatively refer to the suborder Gobiina under the superfamily Gobioidea. It shows relationships with the Microdesmidae, but because of its distinctive dentition and

horizontally placed mouth, I assign it the rank of family. The genus needs more careful study, but this must await a series of fresh specimens. Only the type is known.

The monotypic genus *Pholidichthys* has the following characters: Body very elongate somewhat compressed, naked; no lateral line; premaxillary nonprotractile; gill openings wide, gill membranes joined to isthmus far forward; branchiostegals 5; dorsal origin about half eye diameter in front of a vertical line through upper edge of gill opening; dorsal and anal fins of flexible simple rays, joined to caudal fin, which

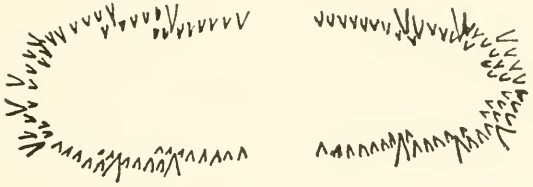

FIGURE 133.—*Pholichichthys leucotaenia* Bleeker, diagrammatic sketch of teeth in jaws of holotype: left, lower jaw; right, upper jaw.

is not rounded but elongate; pelvics I,2, spine very short (only visible under magnification) and inner rays longest; anus just in front of anal fin origin; teeth in both jaws conical, in 4 overlapping rows, with a few canines at front of jaws; no teeth on vomer, palatines, or tongue; pharyngeals with teeth; first 2 anal rays are noncross-striated; first several rays of dorsal broken off, but all remaining ones cross-striated; caudal fin with 10 simple cross-striated rays; dorsal rays 78; anal 62; pectoral 15 and 15; gill rakers 4+8 (no raker at angle); above upper lip at each side of tip of snout is a pair of pores (probably the anterior nostrils) that connect with the posterior nostril by a separate tube beneath the skin; the posterior nasal pore is a little in front of eye; 3 pores on each lower side of dentary; other pores may be present behind eye and on lower part of head but skin is too damaged to determine their location.

KEY TO THE FAMILIES GOBIIDAE, PHOLIDICHTHYIDAE, KRAEMERIIDAE, AND MICRODESMIDAE

1*a*. Lower jaw not notably projecting in front of snout, chin normal, not swollen, and not entering profile.

2*a*. Body normally with scales; first 5 to 6 dorsal rays nonstriated spines; second dorsal with one spine followed by 7 to 32 soft rays; a slightly larger space between last spine of first dorsal and first spine of soft dorsal than occurs fore or aft between bases of rays; pelvics I,3 to 5; anal with 1 spine and 7 to 32 soft rays ..... **Gobiidae**

2*b*. Body naked; dorsal and anal fins long, joined to caudal fin; origin of dorsal over rear of head; about 78 dorsal and 62 anal rays; gill rakers 4+8; pelvic rays I,2; teeth conical in 4 overlapping rows in both jaws; gill membranes free but attached far forward to isthmus. **Pholidichthyidae**

1*b*. Lower jaw notably projecting in front of snout, chin usually swollen forming part of dorsal profile of head; pelvic rays I,3 to 5; body naked or scaled or with embedded scales.

3*a*. First 4 to 6 dorsal rays nonstriated or feeble spines followed by about 13 to 18 striated or soft rays; tongue bilobed at tip; gill membranes free forward, not restricted to sides; eyes superior in position; body naked or scaled.....**Kraemeriidae**

3*b*. First 12 to 22 dorsal rays nonstriated feeble spines, closely followed by about 22 to 55 soft or striated dorsal rays; tongue simple at tip, gill membranes restricted or not restricted to sides of head; eyes lateral to almost superior position; body naked or with minute embedded scales.....**Microdesmidae**

KEY TO THE GENERA OF KRAEMERIIDAE AND MICRODESMIDAE

1*a*. Dorsal fin rays totaling fewer than 25; anal fin rays fewer than 17, tongue bilobed at tip;[1] dorsal and anal fins free from caudal fin. (KRAEMERIIDAE.)

2*a*. Opercular opening not restricted to side of head, gill membranes free far forward along isthmus.

3*a*. Single dorsal fin, feeble spiny portion connected with soft-rayed portion; pelvic rays I,5; body naked; eyes superior in position.

4*a*. Pelvic fins not united along midline; edges of maxillary, dentary, preopercle, and subopercle scalloped; dorsal rays V,14 or 15; anal I,11 to 14; pectoral rays 4 to 8...**Kraemeria** Steindachner

4*b*. Inner pelvic rays joined by membrane along edges; dorsal fin rays V or VI,17 or 18; pectoral 9 or 10; anal rays total 14 or 15; no scallops anywhere on head.....**Gobitrichonotus,**[2] Fowler

3*b*. Two dorsal fins, first feeble spines not connected with soft-rayed part of dorsal fin; pelvics I,4, not joined by membrane; body scaled; eyes lateral; anal rays I,13 or 14; dorsal fin rays V–15, pectoral 15. **Kraemericus,** new genus

2*b*. Opercular opening restricted to side of head, gill membranes joined to isthmus; single dorsal fin, with about IV,16 rays; anal rays about I,13; pectoral 15; pelvics I,5; body naked; lower jaw not entering dorsal profile of snout.....**Parkraemeria**[3] Whitley

1*b*. Dorsal fin single, rays totaling more than 30; anal rays more than 24; tongue simple at tip.

5*a*. Opercular opening extending forward along isthmus, gill membranes free from it; dorsal and anal fins confluent with caudal fin; dorsal rays about 78; anal 62; pectoral 15; body naked; jaws equal or nearly so. **Pholidichthys**[4] Bleeker

5*b*. Opercular opening restricted to side of head or gill membranes joined across isthmus with free fold.

---

[1] This character not recorded for *Parkraemeria*.

[2] *Gobitrichonotus* Fowler, U.S. Nat. Mus. Bull. 100, vol. 14, pt. 2, p. 85, fig. 22, 1943 (type species, *Gobitrichonotus radiocularis* Fowler; holotype USNM 99549, paratype USNM 99550).

[3] *Parkraemeria* Whitley, Rec. Australian Mus., vol. 22, p. 402, fig., 1951 (type species, *Parkraemeria ornata* Whitley).

[4] *Pholidichthys* Bleeker, Nat. Tidschr. Nederl.-Indie, vol. 11, pp. 385, 406, 1856 (type species, *Pholidichthys leucotaenia* Bleeker).

6*a*. Dorsal and anal fins joined to caudal fin; opercular opening restricted to side of head; dorsal rays 41 to 78; anal 26 to 61; pelvics I,3; eyes superior to somewhat lateral in position----**Microdesmus**[5] Günther

6*b*. Dorsal and anal fins free from caudal fin.

7*a*. Gill membranes joined across isthmus, forming a free fold across isthmus; dorsal rays total about 36; anal 26; pectoral 12, pelvics I,3; upper edge of opercular opening opposite base of sixth or seventh pectoral ray----------**Allomicrodesmus**, new genus

7*b*. Gill membranes joined to isthmus without free fold; the opercular opening restricted to side of head.

8*a*. Pelvic rays I,4; gill opening in front of pectoral fin and slightly greater than base of pectoral fin; upper edge of opercular opening opposite upper edge of pectoral base; dorsal rays 56 to 61; anal 34 to 41----------**Gunnellichthys**

8*b*. Pelvic rays I,3; gill opening beginning about middle of pectoral base and continuing a little below lower level of pectoral base; dorsal rays 46 or 47; anal 28 to 30-------**Clarkichthys** Smith[6]

Family KRAEMERIIDAE

This family is characterized by having a moderately elongated naked or scaled body, with lower jaw projecting, chin enlarged, entering dorsal profile of snout; dorsal and anal fins free from caudal fin; first six dorsal rays feeble nonstriated spines, remaining rays striated; first anal ray feeble spine, remaining rays striated; eyes small, superior or lateral in position; pelvics I,5, inner rays longest; tongue bilobed at tip.

For the diagnosis of this family Gosline (1955, p. 167) states: "Gill openings extending rather far forward, the gill covers narrowly attached to the isthmus . . . . Dorsal and anal free from caudal. Pelvics separate or united. Dorsals separate or united."

The projecting lower jaw of *Kraemeria* resembles that of the genera *Gunnellichthys*, *Microdesmus*, and *Allomicrodesmus* with which it appears to be related. Also certain genera in the gobiid family Taenioididae look much like the Kraemeriidae and the Microdesmidae, except that in the former the pelvics are cuplike. *Gobitrichonotus radiocularis* Fowler, except for the fused pelvics, is very similar to *Kraemeria* and *Allomicrodesmus*. I do not believe that united pelvic fins is a family character sufficient to link these fishes; thus, I include *Gobitrichonotus* in the family Kraemeriidae.

---

[5] *Microdesmus* Günther, Proc. Zool. Soc. London, p. 26, 1864 (type species, *Microdesmus dipus* Günther).
Cerdale Jordan and Gilbert, Bull. U.S. Fish Comm., vol. 1 (1881), p. 332, 1882 (type species, *Cerdale ionthas* Jordan and Gilbert).
Leptocerdale Weymouth, Proc. U.S. Nat. Mus., vol. 38, p. 142, 1910 (type species, *Leptocerdale longipinnis* Weymouth).

[6] *Clarkichthys* Smith, J. L. B., Rhodes Univ., Ichthy. Bull. No. 9, p. 128, 1958 (types species, *Cerdale bilineata* Clark). I have examined one specimen, adult female with eggs, standard length 23 mm.; dorsal rays 46; anal 30, pectoral 14, pelvics I,3, USNM 101685 from Port Utria, Colombia).

Genus KRAEMERIA Steindachner

Kraemeria Steindachner, Sitzb. Akad. Wiss. Wien, vol. 115, pt. 1, p. 41, July 1906 (type species, *Kraemeria samoensis* Steindachner).

Vitreola Jordan and Seale, Bull. U.S. Bur. Fish., vol. 25 (1905), p. 393, December 1906 (type species, *Vitreola sagitta* Jordan and Seale).

Psammichthys Regan, Trans. Linn. Soc. London, ser. 2, Zool., vol. 12, pt. 3, p. 246, 1908 (type species, *Psammichthys nudus* Regan).

Schidokraemeria Rofen, Natural History of Rennell Island, British Solomon Islands, vol. 1, No. 10, p. 181, 1958 (type species, *Kraemeria bryani* Schultz, subgenus).

Rofen (1958, p. 181) recognized in his paper on the Rennell Island fishes the following species in the genus *Kraemeria: samoensis* Steindachner; *bryani* Schultz; *cunicularia* Rofen; *nudum* (Regan); *tongaensis* Rofen; and *galatheaensis* Rofen.

KEY TO CERTAIN SPECIES OF KRAEMERIA

1*a*. Pectoral rays 7 or 8 ..... **K. samoensis** Steindachner
1*b*. Pectoral rays 3 to 5 ..... **K. bryani** Schultz
1*c*. Pectoral rays 6 ..... **K. sexradiata** Matsubara and Iwai

KRAEMERIA SAMOENSIS Steindachner

Kraemeria samoensis Steindachner, Sitzb. Akad. Wiss. Wien, vol. 115, pt. 1, p. 41, July 1906 (type locality, Samoa).—Schultz, Journ. Washington Acad. Sci., vol. 31, No. 6, pp. 269–272, 1941; U.S. Nat. Mus. Bull. 180, p. 260, 1943 (key to species).

Vitreola sagitta Jordan and Seale, Bull. U.S. Bur. Fish., vol. 25 (1905), p. 393, pl. 37, fig. 1, Dec. 1906 (type locality, Pago Pago, Samoa; holotype USNM 51784).

Psammichthys nudus Regan, Trans. Linn. Soc. London, ser. 2, Zool., vol. 12, pt. 3, p. 246, pl. 31, fig. 1, 1908 (type locality, Seychelles); Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 733, 1911 (Psammichthyidae).

SPECIMENS STUDIED

Rongerik Atoll: Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 1 specimen, 17.5 mm.

Arno Atoll: Ine Island, June 21, 1950, Strasburg and Hiatt, 29 specimens, 14.3 to 25.4 mm.

Description.—The Bock Island specimen has 19 dorsal rays, 14 anal, 7 and 8 pectoral, and I,5 pelvic rays. Head 3.4; greatest depth 9; tip of snout to dorsal origin 2.8; all in standard length. Snout 4.5; length of pectoral fin 5.0; all in length of head.

Body elongate, somewhat compressed, naked; lower jaw projects considerably in front of tip of snout with an enlarged chin forming part of dorsal profile; a few dermal cirri around the mouth on lower jaw, no cirri on edges of lips; origin of dorsal fin in front of anal opening, which is close in front of anal fin origin; operculum elongate, covering base of pectoral fins; gill membranes free from isthmus; lateral line not evident and no pores observed; sides of body with minute dermal folds that might be scale pockets, but no scales observed; maxillary not slipping under preorbital; minute teeth occur

TABLE 120.—*Counts for species of* Kraemeria *and* Gobitrichonotus

Genera and species	Fin rays																		
	Dorsal						Anal				Pectoral								Pelvic
	19	20	21	22	23	24	12	13	14	15	3	4	5	6	7	8	9	10	I,5
Kraemeria																			
samoensis	2	1							2	1					2	3			4
bryani	4	12					2	3	12	1	9	24	2						16
Gobitrichonotus																			
radiocularis				1	4	1			3	3							5	3	6

on jaws and a few on palatines; eyes small, located dorsally and close together; interorbital narrow, convex; anterior nostril tubular, posterior one not observed; tip of tongue bilobed, free.

Color in alcohol.—Yellowish white, eye black, otherwise unpigmented.

Color when alive.—Translucent.

Ecology.—This species was found living in loose coral sand where wave action was severe.

Remarks.—This species is widely distributed in the tropical central and western Pacific, and in the Indian Ocean.

KRAEMERIA BRYANI Schultz

PLATE 124,A

Kraemeria bryani SCHULTZ, Journ. Washington Acad. Sci., vol. 9, No. 6, p. 271, fig. 1, 1941 (type locality, Hawaiian Islands); U.S. Nat. Mus. Bull. 180, p. 262, 1943.

SPECIMENS STUDIED

Rongerik Atoll: Bock Island, ocean reef, June 27, S-46-237, Schultz and Herald, 4 specimens, 8.5 to 18.5 mm.

Description.—Dorsal rays 20, anal 13 or 14, pectoral rays 4, pelvics I,5, branched caudal rays about 7 or 8.

This species agrees so closely with *K. samoensis* except for the fewer number of pectoral fin rays that no description is given. However, certain anatomical details are observable on the largest specimen of this series that help verify similar observations for *K. samoensis*.

A dermal lobe occurs on under side of chin. This lobe has cirri on its front edges; preorbital margin with a series of cirri and side of lower jaw with a similar dermal fold with cirri; gill membranes joined to side of isthmus forward. There are a few black pigment cells in preorbital region. The dorsal fin is composed of two parts, the first five rays appear to be unsegmented, then a space followed by what appears to be segmented rays, but all are connected by a membrane.

Remarks.—The occurrence of both *Kraemeria samoensis* and *K. bryani* in the northern Marshall Islands is the first time both species have been reported in the same general locality. This indicates that *K. bryani* may have a wide range in the tropical Pacific.

KRAEMERICUS, new genus

Type species.—*Kraemericus chapmani*, new species.

This new genus is characterized by its two dorsal fins; dorsal and anal fins free from caudal fin; gill openings extend far forward along isthmus, with gill membranes free from isthmus; body scaled; no lateral line; tongue bilobed at tip; lower jaw longest swollen at tip, entering dorsal profile; eyes lateral in position; inner pelvic ray longest; gill rakers obsolete.

This genus appears to be related to the Kraemeriidae more than the Microdesmidae. The key on p. 4 distinguishes it from related genera.

KRAEMERICUS CHAPMANI, new species

FIGURE 134

Holotype.—USNM 114697, New Hebrides, Espiritu Santo Harbor, Apr. 25, 1944, Chapman, a specimen 16 mm. in standard length taken from coral heads, total length 18.5 mm.

Description.—Detailed measurements were made on the holotype and these are expressed in thousandths of the standard length: Length of head 231; tip of chin to rear of head 256; greatest depth 106; diameter of eye 44; snout 44; interorbital space 25; snout tip to dorsal origin 313; snout tip to anus 512; longest ray of dorsal 88; of anal 88; of caudal 156; of pectoral 181; of pelvic 175; distance from tip of snout to rear edge of maxillary 69.

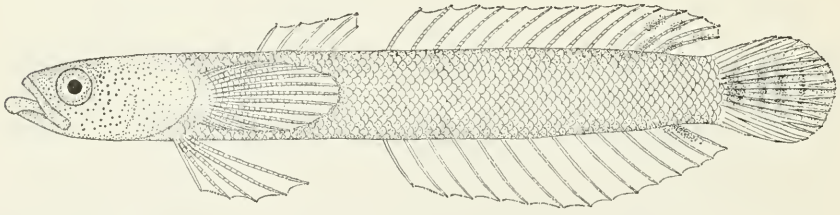

FIGURE 134.—*Kraemericus chapmani*, new species, holotype, USNM 114697, from the New Hebrides. Drawn by Dorothea B. Schultz.

Dorsal V–15; anal 14(I,13); pectoral 15–15; pelvics I,4–I,4; caudal fin rays iii,7,iv; branchiostegals 6; scales about 60.

Anal fin origin under base of second soft dorsal ray; one or two rows of conical teeth in both jaws; probably no teeth on vomer or palatines; maxillary oblique in position, vertical line through rear edge passing slightly in front of pupil; eye large, lateral in position, membraneously attached to skin around eye; two pairs of nasal openings, one dorsally

at front of eye, the other next to upper lip; premaxillary not protractile; head naked and predorsal area probably naked.

Color in alcohol.—Light brownish.

Remarks.—This new species differs from others in the family Kraemeriidae as indicated in the keys.

Named in honor of Dr. Wilbert M. Chapman who collected the holotype.

Family MICRODESMIDAE

After studying several genera of fishes that appear to be related, I tentatively assign the following characters to this family: Body elongate, sometimes eellike; naked or with fine embedded scales; no lateral line; pelvis I,3 to I,5, inserted under base of pectorals; inner rays of pelvics longest; lower jaw projecting, sometimes entering dorsal profile of snout; anterior tip of lower jaw enlarged and fleshy; lips broad; anterior nostrils near tip of snout, somewhat tubular; a nasal pore occurs just in front of dorsal edge of eye; conical teeth in jaws in 1 to 3 series; dorsal and anal fins long, connected with caudal fin by a membrane or free from caudal fin; dorsal fin origin in anterior third of standard length but behind upper edge of gill opening; anal fin origin just behind anus; caudal fin distinct, with about 13 to 17 (based on counts of *Microdesmus* made by C. Richard Robins) cross-striated rays, 9 to 11 of which may be branched in certain genera; anterior 14 to 22 dorsal rays are noncross-striated feeble spines, remainder are cross-striated; anterior 0 to 2 anal rays noncross-striated, remainder are cross-striated; vertebrae number 19 to 32+22 to 40=41 to 62; gill openings restricted to sides or free from isthmus; air bladder present; wide opening behind fourth gill arch; gill rakers small knobs, not very numerous.

Gosline (1955, p. 169) defines the family Microdesmidae thus: "The peculiarities of the family within the suborder Gobioidei consists chiefly of the elongation of the body with the correlated increase in vertebrae number and the continuous dorsal fin without distinction between spines and rays. In addition, however, it has a peculiar maxillary structure in that the maxillaries send out anterior prolongations which meet or nearly meet each other on the midline in front of the premaxillary pedicels." I agree with Gosline except in regard to "spines and [soft] rays," since there are striated and nonstriated rays in the median fins.

J. L. B. Smith (Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 518–520, 1951) discusses the relationship of *Paragobioides* and concludes that its closest allies are the Ammodytidae and the Trichonotidae. In the former, the abdominal vertebrae are more numerous than the caudal, whereas in the Microdesmidae, the caudal vertebrae are notably more numerous. The Ammodytidae lack an air bladder.

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Berg (Classification of fishes, both Recent and fossil, p. 480, 1940) places this family under the "Suborder Blennioidei," in which the pelvic fins are inserted in a "jugular or mental" position. However, the pelvic fins of the microdesmids are inserted under the base of pectorals and are not jugular in position. I believe this family should be placed under Berg's "Superfamily Eleotrioidae" along with the Kraemeriidae. The very small size of some of the species in this family makes it extremely difficult to examine certain characters, even under a wide-field binocular microscope.

Genus GUNNELLICHTHYS Bleeker

Gunnellichthys Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 3, pp. 3, 9, 1858 (type species, *Gunnellichthys pleurotaenia* Bleeker).

Dr. J. L. B. Smith (Rhodes Univ. Icthy. Bull. No. 9, pp. 123–129, figs. 1–2, 1958) published a revision of the fishes related to *Gunnellichthys* and established the new family name Gunnellichthyidae. This action was unnecessary since at least two other family names were available and one, Microdesmidae, is in wide use. In addition, he described two new species and established a new genus in the family. However, Fowler (Mem. Bishop Mus., vol. 12, No. 2, p. 152, 1949) probably was the first to recognize and publish on the relationship of *Microdesmus gertrudae* (Fowler)—which is a synonym of *Gunnellichthys pleurotaenia*)—to the family Microdesmidae, in which family he placed the species.

I have studied Smith's descriptions and figures, and from specimens of *G. monostigma*, *G. irideus*, and *G. copleyi* kindly sent to me by Smith and from specimens in the collections here the following key was prepared.

KEY TO THE SPECIES OF GUNNELLICHTHYS

1*a*. Anal fin origin slightly closer to tip of snout than midbase of caudal fin; a dark stripe from snout through eye along side of body to rear of middle caudal fin rays, another dark stripe along middorsal line, thence along base of dorsal fin; a dark line across dorsal fin; dorsal fin origin over front half of length of pectoral fin.

2*a*. Dorsal rays 56 to 60; anal 34 to 39_____**G. pleurotaenia** Bleeker

2*b*. Dorsal rays 60 to 63; anal 38 to 40_____**G. copleyi** Smith[7]

1*b*. Anal origin closer to caudal fin base than tip of snout; color pattern not as in 1*a*.

3*a*. Rear tip of opercle with a black spot; pelvics shorter than pectorals, dorsal rays 60 to 61; anal 39 to 41_____**G. monostigma** Smith[8]

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[7] *Paragobioides coplcyi* Smith, J. L. B., Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 518–527, figs. 1, 2, 1951 (type locality, Mozambique Island, Baixo Pinda (12° S), and Mombasa).

Gunnellichthys (*Gunnellichthys*) *copleyi* Smith, Rhodes Univ. Ichthy. Bull. No. 9, p. 126, fig. 2D, 1958 (Pinda).

[8] *Gunnellichthys monostigma* Smith, ibid., p. 127, fig. 2E, (type locality, Pinda, Mozambique).

3*b*. Rear tip of opercle without black spot; pelvics about same length as pectorals; dorsal rays 58 to 59; anal 37 to 38_____G. **irideus** Smith[9]

GUNNELLICHTHYS PLEUROTAENIA Bleeker

PLATE 124,B

Gunnellichthys pleurotaenia BLEEKER, Act. Soc. Sci. Indo-Néerl., vol. 3, p. 10, 1858 (type locality, off Menado in Celebes Sea.)—de Beaufort *in* de Beaufort and Chapman, Fishes of the Indo-Australian Archipelago, vol. 5, p. 448, fig. 86, 1951 (Bali; Celebes).

Paragobioides grandoculis KENDALL and GOLDSBOROUGH, Mem. Mus. Comp. Zool., vol. 26, No. 7, p. 324, pl. 6, fig. 2, 1911 (type locality, Arno Atoll, Marshall Islands; holotype USNM 65975).

Taenaeoides gertrudae FOWLER, Bernice P. Bishop Mus. Bull. 22, p. 17, 1925 (type locality, Guam); Mem. Bishop Mus., vol. 10, p. 419, fig. 64, 1928 (*Taenaeoides* an error for *Taenioides*).

Microdesmus gertrudae FOWLER, Mem. Bishop Mus., vol. 12, No. 2, p. 152, 1949 (first referral to family Microdesmidae).

SPECIMENS STUDIED

Marshall Islands: Arno Atoll, holotype of *P. grandoculis* (USNM 65975).

Guam: tidepool, June 29 and July 7, 1949, Eugenie Clark, 1 specimen, 55.3 mm. in standard length (USNM 163658).

Philippines: Luzon Island, Port Matalvi, 1 specimen, 47 mm.

Description.—Detailed measurements were made on the Guam specimen and these are expressed in thousandths of the standard length, which is 55.3 mm. (total length 59.9 mm.): Length of head 141; tip of chin to rear of head 154; greatest depth 76; diameter of eye 25; snout 33; interorbital space 14; snout tip to dorsal origin 154; snout tip to anus 474; longest ray of dorsal 47, anal 51, caudal 99, pectoral 68, and pelvic 29.

TABLE 121.—*Counts for species of* Gunnellichthys

Species	Dorsal rays						Anal							Pectoral	
	58	59	60	61	62	63	35	36	37	38	39	40	41	13	14
*pleurotaenia**	3	1	1	-----	-----	-----	1	2	1	1	-----	-----	-----	4	3
*copleyi***	-----	-----	2	2	8	4	-----	-----	-----	1	5	9	1	-----	1
*monostigma***	-----	-----	1	3	1	-----	-----	-----	-----	1	2	1	1	-----	2
*irideus***	5	3	-----	-----	-----	-----	-----	-----	3	5	-----	-----	-----	2	-----

*These counts include Bleeker's types and the holotype of *P. grandoculis*.

**The counts recorded for these species were kindly furnished by Dr. J. L. B. Smith in a letter dated March 11, 1958.

Dorsal rays XIX,39=58; anal 36; pectoral i,12–i,13; pelvic I,4; caudal ii+11+ii. It is very difficult to observe the presence or absence of cross-striations in the first and second anal rays. The anal fin origin is under the nineteenth dorsal fin ray.

[9] *Gunnellichthys irideus* Smith, ibid., p. 128, fig. 2F, (type locality, Pinda, Mozambique).

Body covered with minute, somewhat embedded scales.

Color in alcohol.—A black streak along middle of side, one along middorsal line of back, and one along middle of length of dorsal fin rays.

Remarks.—Kendall and Goldsborough described *Paragobioides grandoculis* and referred it to the Gobiidae. Their description is inadequate and their figure 2 is in error regarding the origin of the dorsal fin. The latter has its origin in front of middle of length of pectoral fin, not behind tip of pectoral as shown by Kendall and Goldsborough. J. L. B. Smith described *P. copleyi* as new, separating it from *P. grandoculis* on the supposed origin of dorsal behind tip of pectoral, a character that does not exist on the holotype, USNM 65975.

Bleeker described *Gunnellichthys pleurotaenia* from Menado in the Celebes Sea as new. I have examined two of Bleeker's specimens, loaned from the Leiden Museum, No. 4799, and cannot detect any differences between them and the other specimens before me from the tropical Pacific. Later de Beaufort *in* de Beaufort and Chapman figured Bleeker's *G. pleurotaenia*. Color pattern, counts, and other details are the same as in *P. grandoculis*, and I conclude that the latter is a synonym of *G. pleurotaenia*.

ALLOMICRODESMUS, new genus

Type species.—*Allomicrodesmus dorotheae*, new species.

This new genus is characterized by having the dorsal and anal fins free from the caudal; gill openings not restricted to the side of head but with a free fold of the branchiostegal membranes across the isthmus; body naked, no lateral line; lower jaw longest, swollen at the tip; tongue simple at tip; eyes large, lateral in position; inner pelvic rays longest; air bladder probably present.

This genus appears to be related to the Krameriidae and to the Microdesmidae. The key on page 4 distinguishes it from the other genera referred to those families.

ALLOMICRODESMUS DOROTHEAE, new species

FIGURE 135

Holotype.—USNM 113960, Bikini Atoll, Enyu Island, reef at entrance to lagoon, S–46–8, Mar. 16, 1946, Schultz, Brock, and Marr, 1 specimen, 20.9 mm. in standard length.

Description.—Detailed measurements were made on the holotype and these are expressed in thousandths of the standard length, which is 20.9 mm. (total length 23.3 mm.): Length of head 139; tip of chin to rear of head 158; greatest depth 81; diameter of eye 14; snout 29; interorbital space 10; snout tip to dorsal origin 257; snout tip to anus

426; longest ray of dorsal 72; anal 48; caudal 105; pectoral 105; pelvic 43.

Dorsal rays XIV,xxii; anal II,xxiv. (Branched rays in dorsal and anal fins are incorrect in figure 135.) Pectoral xii and xii; pelvics, I,iii and I,iii; caudal vii,xiii,v; vertebrae ?20+27; anal fin origin

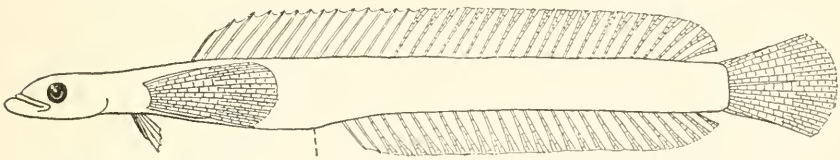

FIGURE 135.—*Allomicrodesmus dorotheae*, new species, holotype, USNM 113960, from Bikini Atoll. Drawn by A. M. Awl.

under fourteenth dorsal ray. I am unable to determine the presence or absence of teeth on vomer or palatines; probably 2 series of conical teeth in jaws; maxillary reaches to a vertical line through front margin of eye.

Color in alcohol.—Light brownish.

Remarks.—This new genus and species differs from its close relatives as indicated in the key to genera.

Named *dorotheae* in honor of my wife, Dorothea Bowers Schultz, who has illustrated many of the new species in this bulletin.

Suborder COTTINA (=SCLEROPAREI)

By LEONARD P. SCHULTZ

Family SCORPAENIDAE: Scorpionfishes

A study of the pectoral fin rays of certain scorpionfishes indicated that the upper pectoral rays do not become fully branched until some individuals have reached a length of 40 to 50 mm. or longer in standard length. Sometimes the first or second soft ray of the dorsal fin is simple, but this has been ignored in recording the ray counts for that fin.

Counts and measurements made on several species are recorded in table 122 and a summary of the cranial spines is given in table 123. Figures 136 and 137 are intended as a guide to the names of the cranial spines for scorpaenid fishes.

In 1943 (U.S. Nat. Mus. Bull. 180, fig. 14, p. 168), I tried to standardize the names of the cranial spines by applying to each particular spine the name of the bone on which it occurred, with the notable exception of the "tympanic" and "nuchal." Since that time I have investigated the cranial spines on almost all of the genera and species

TABLE 122.—*Counts for various species of* Scorpaenidae

Genus and species	Dorsal rays							Anal rays			Pores in lateral line						Pectoral fin rays																		
	XII	XIII	XIV	7	8	9	10	III	4	5	20	21	22	23	24	25	i	ii	iii	iv	v	vi	2	3	4	5	6	7	viii	ix	x	xi	xii	xiii	xiv	xv	xvi
Sebastapistes																																					
albobrunnea	21					20	1	11		11					4	4	23								1	21	1			2	19	2					
mcadamsi	14					14		10		10			4	3			16	7				4	5	8	10					7	8	11					
corallicola	12					12		10		10		1	1	5			10	9						4	7	8				1	12	6					
bynoensis	3				1	2		3		3	1	1																						*2	*2	*1
Scorpaenopsis																																					
gibbosa	7					7		7		7			1	1	2		9								3	5	1					1	4	4			
Scorpaenodes																																					
kelloggi		2			2			2		2	2							2	2							2	2		3	1						
guamensis		37	1	3	35			13	1	12			1	5	1		5	15	9	1				2	11	10	6	1		1	3	17	9				
parvipinnis		6				6		6		6			4	1	1		4	8								2	8	2		2	9	1					

	Number of vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin																							
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Sebastapistes																							
albobrunnea																				1	3	4	1
mcadamsi											3	2	2	1	1								
corallicola												1	1	3	3								
bynoensis											1		1	1									
Scorpaenopsis																							
gibbosa														1	2	4							
Scorpaenodes																							
kelloggi	1	1																					
guamensis											1	1	2	3	2	1	1	2					
parvipinnis																1	1	1		1	2		

*All simple rays on young counted.

of scorpaenid fishes in the National Museum. That study caused me to change some of the conclusions reached prior to 1943, especially those involving the region of the postocular and postfrontal spines. In order to know what name to apply to those spines, I studied that area from the evolutionary viewpoint.

My observations concerning the postfrontal and postocular spines and related ones are recorded in figure 137. In that figure, *a* to *f* illustrates the most simple conditions found in scorpaenid fishes. The parietal spine and ridge is a stable character, although there may be two spines. Between the orbits, in front of the parietal spine, there may be an interorbital ridge (fig. 137,*b*) that varies as it continues posteriorly, either leading into the base of the parietal spine or curving into the postfrontal spine (fig. 137,*b,d,f,g,i,j*). An occipital pit may or may not occur; if it is present, the postfrontal spine is located at its anterior corner and the parietal near its posterior one (fig. 137,*j,k,l,n*).

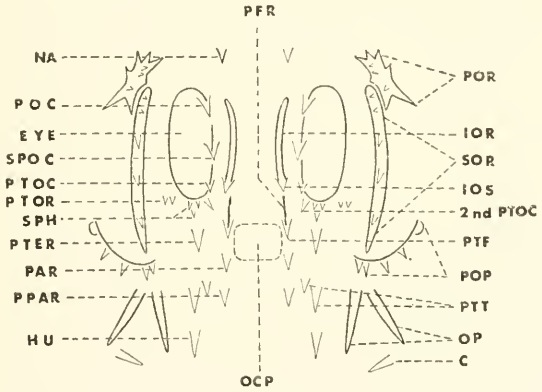

FIGURE 136.—Diagrammatic sketch showing location and names of the cranial spines of scorpaenid fishes. C, cleithral; HU, humeral; IOR, interorbital ridge; IOS, interorbital spine; NA, nasal; OCP, occipital pit; OP, opercular; PAR, parietal; PPAR, posterior parietal; PFR, postfrontal ridge; POC, preocular; POP, preopercular; POR, preorbital; PTER, pterotic; PTF, postfrontal; PTOC, postocular; second PTOC, second postocular; PTOR, postorbital; PTT, posttemporal; SOR, suborbital; SPH, sphenotic; SPOC, supraocular.

By following the interorbital ridge and its continuation that forms the postfrontal ridge, it is possible to distinguish, with few exceptions, which spines at the rear of the orbit are postocular and which are postfrontal (fig. 137,*l,m,n,o*). Sometimes the interorbital ridge has a spine between the orbits farther forward than the usual position of postfrontals or postoculars, and this is recognized as the interorbital spine (fig. 137,*k*). Thus, it was concluded that in certain species of scorpaenid fishes there are two postoculars, one of which has been called the "tympanic spine," a term that should be dropped.

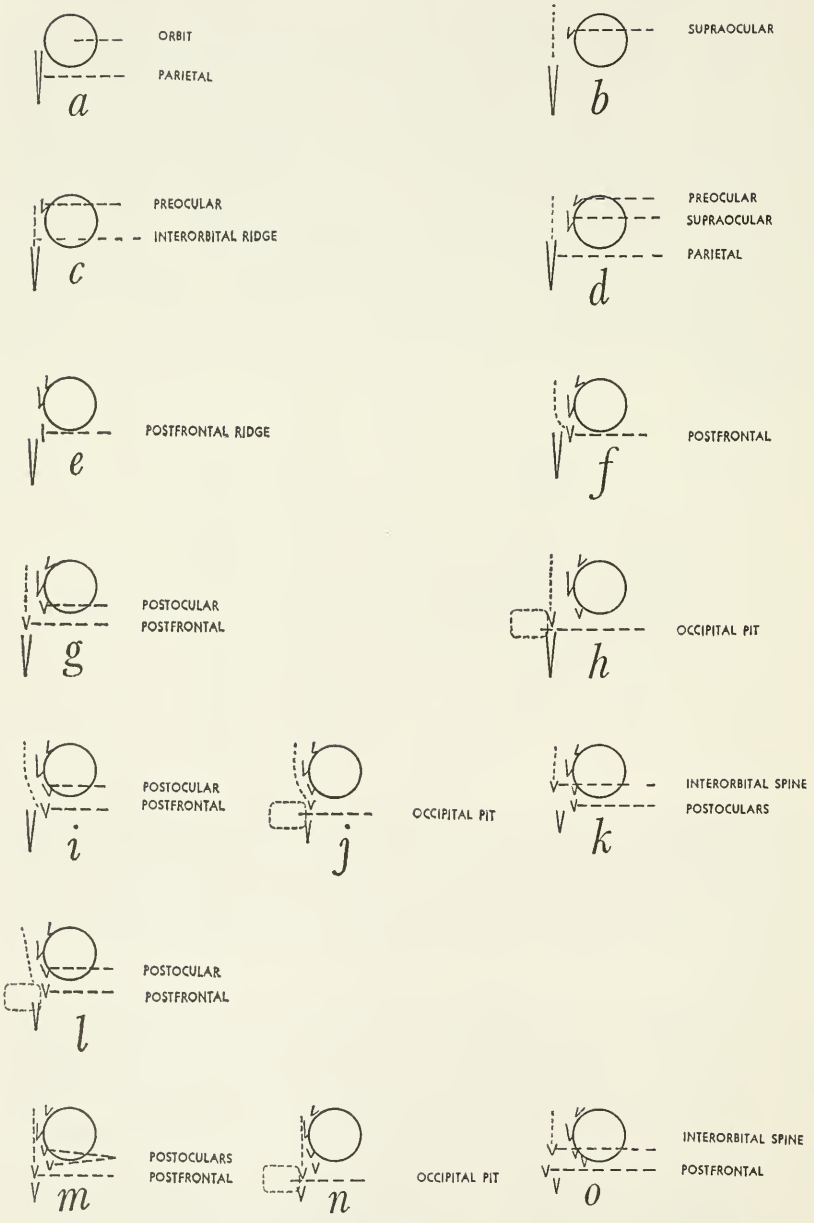

FIGURE 137.—A diagram showing the probable relationships of the postfrontal and postocular spines on scorpaenid fishes (see p. 15 for discussion).

After the present study of this family had been completed and during the period that Isaac Ginsburg was studying western Atlantic scorpionfishes, we discussed the desirability of a uniform terminology for the cranial spines of the family Scorpaenidae. Figure 2 in his important paper, "Western Atlantic Scorpionfishes" (Smithsonian Misc. Coll., vol. 121, No. 6, 1953) demonstrates that we have both adopted the same terminology. (See also fig. 138.)

KEY TO THE SCORPIONFISHES OF THE NORTHERN MARSHALL ISLANDS

1*a*. Dorsal fin connected by membrane to dorsal edge of caudal fin nearly halfway out its length; body greatly compressed, its thickness through pectoral bases about 2⅓ to 3 times in the greatest depth; body naked; dorsal rays XII,x or xi; anal III,6; pectoral rays xiv; pores in lateral line 21 or 22; gill rakers 5 or 6+1+12_____**Taenianotus triacanthus** Lacepède

1*b*. Dorsal fin not membraneously connected with caudal fin; greatest thickness of body through pectoral bases contained fewer than 2 times in greatest depth.

2*a*. Front of snout next to premaxillary groove with 3 simple barbels, 1 median and 1 on each side; branched caudal fin rays normally 5+5.

3*a*. Upper pectoral fin rays unbranched, as are all pectoral rays, much longer than lower swollen unbranched rays, pectoral rays more or less threadlike, usually (except in young) reaching past caudal fin; dorsal spines elongate, somewhat flexible and much longer than length of head.

4*a*. Pectoral fin with 16 to 18 unbranched rays; dorsal rays usually XII,11, anal III,6; about 8 to 10 wide dark bars, often with narrower bars between.

5*a*. Supraorbital tentacle plain blackish with white margin and tips white; caudal peduncle with a single lengthwise dark blotch; no narrow dark bars in the white area between wide dark bars; all fins plain pale_____**Pterois radiata** Cuvier and Valenciennes

5*b*. Supraorbital tentacle barred with black and white; caudal peduncle with 2 or 3 vertical to oblique narrow dark bars; 3 narrow dark bars (only one in young) in white area between wide dark bars; soft dorsal and anal fins and caudal fin barred.

Pterois antennata (Bloch)

4*b*. Pectoral fin with 12 to 14, rarely 15, unbranched rays; dorsal rays XIII,11 or 12 and anal usually III,7; from 17 to 30 vertical dark bars.

6*a*. Pectoral rays usually 12 or 13; pelvics white with black spots; supraorbital tentacle shorter than diameter of pupil; dorsal edge of pectoral base with a blackish blotch without white spot; underside of head usually plain pale without black lines or streaks; figure 138,K_____**Pterois lunulata**[10] Temminck and Schlegel

6*b*. Pectoral rays usually 14 or 15; pelvics black with white spots; supraorbital tentacle long, barred with black and white; dorsal edge of pectoral base with a distinct white spot surrounded by black; underside of head usually streaked with black.

Pterois volitans (Linnaeus)

[10] Not collected by us in the northern Marshall Islands.

TABLE 123.—*Pairs of cranial spines on some species of Scorpaenid fishes*
Presence or absence of palatine teeth

Genus and species	Nasal	Preocular	Supraocular	Postocular	Second postocular	Interorbital ridge	Interorbital spine	Sphenotic	Pterotic	Postfrontal	Parietal	Posterior parietal	Occipital pit	Humeral	Posttemporal	Cleithral	Preorbital	Suborbital	Postorbital	Preopercular	Opercular	Palatine teeth
Brachirus bicellatus	1	1	1	1	+	+	–	2	1	+	1	1	–	1	1	–	1	2	2	4	1	–
Sebastapistes albobrunnea	1	1	1	1	–	+	–	2–4	1	1	1	1	–	1	2	1	5	1	1–3	6	2	+
Sebastapistes mcadamsi	1	1	1	1	–	+	–	2–4	1	1	1	1	+	1	2	1	2	1–2	0–2	4–5	2	+
Sebastapistes coralicola	1	1	1	1	+	+	–	2–4	1	1	1	1	+	1	2	1	3	1	1–2	5	2	+
Sebastapistes bynoensis	1	1	1	1	+	+	–	3–4	1	1	1	1	–	1	2	1	2	3	1–2	6	2	+
Scorpaenopsis gibbosa	2–6	1	1–2	1–2	1–2	+	–	2–4	1–3	1	1–2	1–3	+	1–5	2–11	1	6–18	3–5	2–5	4–5	2	–
Scorpaenodes kelloggi	1	1	1	1	–	+	1	3	1	1	1	1	–	1	1	1	–	3	1	4	2	–
Scorpaenodes guamensis	1	1	1	1	–	+	–	1–3	1	1	1	1	–	1	1	1	2	2	2–4	4	2	–
Scorpaenodes parvipinnis	1	1	1	1	–	+	1	6–9	1	0–1	1	1	–	1	2	1	3	5–8	1–2	4	2	–
Hypomacrus brocki, new species	–	1	1	1	+	+	–	1–2	1	–	1	1	–	1	1	1	–	2	–	3	2	–

3*b*. Upper pectoral fin rays branched (except possibly in young) and pectoral fin not extending past base of caudal fin; dorsal spines about equal to length of head; dorsal rays VIII,9; anal III,5; soft dorsal with two black ocellate spots_____**Brachirus biocellatus** (Fowler)

2*b*. Front of snout without the 3 simple barbels next to the premaxillary groove; dorsal spines notably shorter than length of head.

7*a*. Mouth terminal, or nearly so; lower pectoral rays simple, swollen, some of upper pectoral rays branched but not swollen, unbranched in young of certain species; anal rays III,5, rarely III,4; branched caudal fin rays 6+5; scales ctenoid.

8*a*. Palatine teeth present; dorsal rays XII,9 (rarely 8 or 10); two posttemporal spines on each side.

9*a*. Vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin about 49 to 52; pectoral rays usually i,4 to 6,ix to xi; no occipital pit present; postfrontal spine in line or nearly so with supra- and post-oculars and parietal-nuchal spines; general coloration brownish with white areas.

Sebastapistes albobrunnea (Günther)

9*b*. Vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin 40 to 45.

10*a*. Second postocular spine absent; postfrontal spine in line, or nearly so, between postocular and parietal spines; shallow occipital pit present, with postfrontal spines at the anterior lateral corners; anterior lower preorbital spine pointing forward and posterior one directed downward, curving forward with age; pale interspaces between vertical dark bars usually wider than dark bar_____**Sebastapistes mcadamsi** (Fowler)

10*b*. Second postocular spine present; postfrontal spine at front of occipital pit and in line with parietal spines; underside of head dusky with dark specks or spots; rear of spiny dorsal sometimes with black blotch.

Sebastapistes corallicola Jenkins

10*c*. Second postocular spine lacking; postfrontal spine behind postocular not in line with parietal spines; occipital pit absent; underside of head barred with dark and pale; body dark with white flecks and pale areas with black specks; no black blotch on dorsal fin.

Sebastapistes bynoensis (Richardson)

8*b*. Palatine teeth absent.

11*a*. Each nasal spine with 2 to 6 points or, in young, grooved if points are undeveloped; a deep pit below orbit; dorsal rays XII,9, pectoral rays i,4 or 5,xi to xiii; occipital pit present; posttemporal spines 2, the number of points on all cranial spines increasing with age; a black area on oral membrane at symphysis of premaxillaries; area behind pectoral fin with ocellate orange spot when alive.

Scorpaenopsis gibbosa (Bloch and Schneider)

11*b*. Each nasal spine, if exposed, with a single point; no pit below orbit; dorsal rays XIII,7 to 9; occipital pit lacking or only slightly developed on *parvipinnis;* only a single posttemporal spine.

12*a*. Longest branched or upper pectoral fin rays nearly as long as lower simple and swollen rays; nasal spines exposed; length of head equal to or only a little longer than length of base of spiny dorsal fin; depth of body about 1.2 in head or equal to length of head; lower simple and swollen pectoral fin rays viii to xii.

13*a*. Vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin 30 or 31; dorsal rays XIII,8; pectoral ii or iii,5 or 6,viii or xi; interorbital spine present at posterior end of interorbital ridge.

Scorpaenodes kelloggi (Jenkins)

13*b*. Vertical scale rows above lateral line 40 to 50; pectoral rays i to iii,3 to 7,ix to xii.

14*a*. Dorsal rays XIII (rarely XIV), 7 to 8 usually 8; no interorbital spines present; a characteristic dark blotch on operculum; body blotched or speckled with brown and pale areas.

Scorpaenodes guamensis (Quoy and Gaimard)

14*b*. Dorsal rays XIII,9; interorbital spine present at posterior edge of interorbital ridge; body, head, and fins with numerous small brown spots.

Scorpaenodes parvipinnis (Garrett)

12*b*. Longest branched or upper pectoral rays notably shorter than lower simple and swollen rays, or about two-thirds length of latter; nasal spines unexposed; length of head about equal to distance from dorsal origin to middle of length of soft dorsal; depth of body about one and one-half in length of head; lower jaw notably entering profile; dorsal rays XII to XIV,7 to 9; pectoral rays i or ii,7 or 8,vi or vii.....**Hypomacrus brocki**, new species

7b. Mouth vertical or nearly so; all pectoral rays branched, fleshy, lower ones giving appearance of being simple because of their excessively fleshy nature; branched caudal fin rays 4+5 in adults; deep pit between the eyes, another behind orbits and one below front of orbits; dorsal spines very short, heavy, XIII,6; anal III,4 or 5; pectoral rays about 18. (Synanceiinae: stonefishes.)

Synanceia verrucosa Bloch and Schneider

Subfamily TAENIANOTINAE

Genus TAENIANOTUS Lacepède

Taenianotus LACEPÈDE, Histoire naturelle des poissons, vol. 4, p. 303, 1802 (type species, *Taenianotus triacanthus* Lacepède, restricted by Bleeker, Versl. Akad. Wet. Amsterdam, vol. 9, p. 299, 1876).

TAENIANOTUS TRIACANTHUS Lacepède

PLATE 126,A,B

Taenianotus triacanthus LACEPÈDE, Histoire naturelle des poissons, vol. 4, p. 303, 1802 (no locality).—SCHULTZ, Copeia, No. 4, p. 206, 1938.

SPECIMENS STUDIED

Bikini Atoll: Amen Island, July 7, 1948, Univ. Washington, 1 specimen, 25 mm.

Bikini Atoll: 1949, Univ. Washington, 1 specimen, 45 mm.

Eniwetok Atoll: Runit Island, Aug. 15, 1949, Univ. Washington, 2 specimens, 45 and 57 mm.

Description—Dorsal rays XII,x or xi; anal III,6 (probably last 5 soft rays branched at tips on adults); pectoral xiv; pelvics I,5; pores in lateral line 21 or 22; gill rakers on first gill arch 5 or 6+1+12.

Depth 1.9 to 2.0; head 2.2 to 2.4; thickness or width of body through pectoral bases 5.6 to 9.5; all in standard length. Snout 2.8 to 3.0; eye 4.0 to 4.2; postorbital part of head 2.0 to 2.1; least depth of caudal peduncle 2.9 to 3.0; longest ray of pectoral fin 1.0 to 1.1; longest dorsal spine 1.3 to 1.4; all in length of head. Least width of bony interorbital 1.3 to 1.5 in eye; least depth of caudal peduncle 1.3 in its length; next to last dorsal spine in last dorsal spine 1.0 to 1.1, and in longest dorsal spine 1.3 to 1.4; length of first anal spine in second 1.5. Pelvics reach a little past anus, about to anal fin origin.

This species is characterized by its compressed head and body, continuous dorsal fin with soft rays abruptly a little longer than last dorsal spines, with the soft dorsal connected by membrane to dorsal edge of caudal fin from a third to half the length of caudal fin; body naked; head, body, and fins with scattered short dermal cirri, most as broad as or broader than long; all soft dorsal and pectoral rays unbranched, but anal may or may not have the tips of soft rays branched, depending on size; second or third dorsal spine longest; third anal spine longest; pectoral rays reaching a little past middle of length of anal fin base; anal fin free from caudal peduncle; teeth in a villiform band on jaw; vomer and palatines edentulous.

Color in alcohol.—Background coloration pale or yellowish with dark brown blotches scattered on head, body, and fins; two dark bars across pectoral; a narrow dark streak extending obliquely downward and backward from eye on cheek. This species has a black color phase or one intermediate between black and yellow.

Ecology.—This species occurs in areas where coral-alga growths are abundant and wave action strong.

Remarks.—*Taenianotus citrinellus* Gilbert is a synonym of this species and represents the yellow color phase (see Schultz, Copeia, No. 4, p. 206, 1938).

Subfamily PTEROIINAE

Genus PTEROIS Cuvier

Pterois OKEN, Isis, p. 1782 [=1182] 1817 (type species, *Gasterosteus volitans* Linnaeus) (reference copied).

Macrochirus SWAINSON, Natural history and classification of fishes . . ., vol. 2, p. 180, 1839.

Macrochyrus SWAINSON, Natural history and classification of fishes . . ., p. 264, spelling emended (type species, "*miles* Benn. Cey, pl. 9").

Pteroleptus SWAINSON, Natural history and classification of fishes . . . , pp. 180, 264 (type species, "*P. longicauda* Russ. ii, pl. 133").

Pteropterus SWAINSON, Natural history and classification of fishes . . . , pp. 180, 264 (type species, "*T. radiatus* Cuv. and Val.").

PTEROIS RADIATA Cuvier and Valenciennes

PLATE 125,A; FIGURE 138,*h*

Pterois radiata CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 4, p. 369, 1829 (type locality, Society Islands).

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 14 specimens, 28 to 83 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 51 mm.
Rongelap Atoll: 1 station, 1 specimen, 60 mm.
Rongerik Atoll: 1 station, 1 specimen, 37 mm.
Kwajalein Atoll: 1 station, 2 specimens, 15 to 18 mm.
Guam: 1 lot, 1 specimen, 49 mm.

Description.—Dorsal rays XII,11 in 7 specimens; anal III,6 in 7; pectoral 16 in 7 and 17 in 4; vertical scale rows 50 to 52 from upper edge of gill opening to midbase of caudal fin and usually about 25 pores.

Depth 2.9 to 3.2; head 2.4 to 2.6; both in standard length. Snout 3.7 to 3.8; eye 2.9 to 3.2; postorbital part of head 2.1 to 2.2; least depth of caudal peduncle 3.2 to 3.8; longest dorsal spine 0.7 to 0.8; length of maxillaries 2.7; all in length of head. Least width of bony interorbital 1.8 to 2.0 in eye; least depth of caudal peduncle in its length 1.6 to 1.7; next to last dorsal spine in last dorsal spine 1.3 to 1.4 and in longest dorsal spine 3.5 to 4.7; length of first anal spine in second 1.7 to 2.0; pelvics reach a little past anal origin; head in longest ray of pectoral fin 2.4 to 3.

Color in alcohol.—Ground color whitish with 8 vertical dark bars; the first from below eye across lower part of gill cover; second just in front of parietal spines and fading behind orbit; third from parietal and nuchal spines across operculum; fourth from first to third dorsal spines to behind pectoral base; fifth from fourth to sixth dorsal spines to abdomen, a little behind pelvic bases; six from seventh to tenth dorsal spines to abdomen, a little in front of anus; seventh from first to fifth soft ray of dorsal to front of anal fin; eighth black bar from between sixth and seventh to tenth soft rays of dorsal fin to rear of anal fin. A lengthwise dark bar occurs on side of caudal peduncle; a round white spot at upper edge of pectoral base usually prominent; blackish pigmentation on pelvics and pectorals, usually separated by a white streak; lower parts of head and breast in front of pelvics white; supraorbital tentacle plain blackish, margined with white and tips white.

Ecology.—This species was found where there were holes in coral growths furnishing protection or hiding places under large blocks of coral. When these blocks were turned over, *Pterois* became visible.

Remarks.—*P. radiata* is the commonest species of tiger fish in the northern Marshall Islands and perhaps in the shallow reef waters of

most of the coral atolls. We examined the type of *P. sphex* Jordan and Evermann, USNM 50550, and believe it a species distinct from both *P. radiata* and *P. antennata*, which it resembles.

PTEROIS ANTENNATA (Bloch)

PLATE 125,B; FIGURE 138,*j*

Scorpaena antennata BLOCH, Ichthyologie ou Histoire naturelle des poissons, vol. 6, pp. 16–17, pl. 185, 1787 (type locality, Amboina).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 3 specimens, 19 to 97 mm. in standard length.
Guam: 1 lot, 4 specimens, 47 to 63 mm.

Description.—Dorsal rays XII,11, anal III,6; pectoral 16 to 18; pelvics I,5.

Depth 2.9; head 2.4; both in standard length. Snout 3.6; eye 3; postorbital length of head 2.2; least depth of caudal peduncle 4.4; all in length of head. Least width of bony interorbital 1.4 in eye; least depth of caudal peduncle in its length 1.7; pelvics reach well past anal origin; supraorbital tentacle in head 1.2; head in longest pectoral ray 1.7.

Color in alcohol.—Ground color pale with 10 dark bars: 1 from rear of eye; 2 from area behind orbits to dorsal origin; 3 below spinous dorsal; 2 below soft dorsal; and 2 oblique, 1 on caudal peduncle. The narrow bars between the wide ones just beginning to form.

Color when alive.—Rich reddish brown vertical bars, margined with white, interspaces light pinkish; basal half of pectoral rays pinkish; the four spots on side of head brownish red; fins barred with white.

Remarks.—In small specimens, pectoral rays do not reach much past base of caudal fin.

PTEROIS VOLITANS (Linnaeus)

PLATE 127,A

Gasterosteus volitans LINNAEUS, Systema naturae, ed. 10, p. 296, 1758 (type locality, Amboina).

SPECIMENS STUDIED

Saipan: 2 lots, 2 specimens, 44 to 53 mm. in standard length.
Guam: 1 lot, 1 specimen, 86 mm.

Description.—Dorsal rays XIII,11; anal III,7; pectoral 14–14; about 90 vertical scale rows from upper edge of gill opening to mid-base of caudal fin.

Depth 3.2; head 2.9; both in standard length. Snout 2.8; eye 4.1; postorbital part of head 2.4; least depth of caudal peduncle 3.4; longest dorsal spine 0.8; length of maxillaries 2.2; all in length of

head. Least width of bony interorbital 1.3 in eye; least depth of caudal peduncle 1.7 in its length; next to last dorsal spine 1.8 in last dorsal spine and 5.4 in longest dorsal spine; length of first anal spine in second 2.0, third anal spine longer than second; pelvics long, reaching nearly to rear of base of anal fin; head about 3 in longest pectoral fin rays.

Color in alcohol.—General ground color pale with 31 vertical narrow dark bars, 11 of these wider and blacker than the others; soft dorsal, anal, and caudal fins barred; pectoral and pelvics plain blackish, latter may have white spots; dorsal spines blackish with tips white; under side of head with narrow black streaks or lines; supraorbital tentacle long, barred with blackish, but the paler interspaces dusky, blackish in the 86 mm. specimen.

Genus BRACHIRUS Swainson

Brachirus Swainson, Natural history and classification of fishes . . . , vol. 2, p. 71 (not p. 180 and 303, replaced by *Synaptura* Cantor) 1839 (type species, *Pterois zebra* Cuvier and Valenciennes).

Brachyurus Swainson (emended spelling), Natural history and classification of fishes . . . , vol. 2, p. 264, 1839 (types species, "*Zebra* Cuvier iv, p. 367"; preoccupied in mammals).

Dendrochirus Swainson, Natural history and classification of fishes . . . , vol. 2, p. 180, 1839 (type species, *Pterois zebra* Cuvier and Valenciennes).

Nemapterois Fowler, Proc. U.S. Nat. Mus., vol. 85, p. 81, fig. 36, 1938 (type species, *Nemapterois biocellatus* Fowler).

BRACHIRUS BIOCELLATUS (Fowler)

Figures 138,*l*; 139

Nemapterois biocellatus Fowler, Proc. U.S. Nat. Mus., vol. 85, p. 81, fig. 36, 1938 (type locality, Philippine Islands; holotype USNM 98894).

SPECIMENS STUDIED

Eniwetok Atoll: 1 station, 1 specimen, 60 mm. in standard length.
Bikini Atoll: 1 lot, Univ. Washington, 1 specimen, 72 mm.

Description.—Dorsal rays XIII,9 or 10; anal III,5; pectoral i to iii,7 to 9,viii to xii; pelvics I,5; branched caudal 5+5 and 6+5; vertical scale rows above lateral line 46, 49, and 50 in the type; pores in lateral line 24 in 3 specimens; gill rakers 6+1+10 and 6+1+11.

Depth 2.5 to 2.6; head 2.5 to 2.6; length of preorbital barbel 3.4; all in standard length. Snout 3.2 to 3.5; eye 3.2 to 3.5; postorbital part of head 2.3 to 2.4; least depth of caudal peduncle 3.0 to 3.1; longest ray of pectoral fin 0.7 to 0.8; longest dorsal spine 1.6 to 1.7; all in length of head. Least width of bony interorbital 2.1 to 2.2 in eye; least depth of caudal peduncle in its length 1.4 to 1.5; next to last dorsal spine in

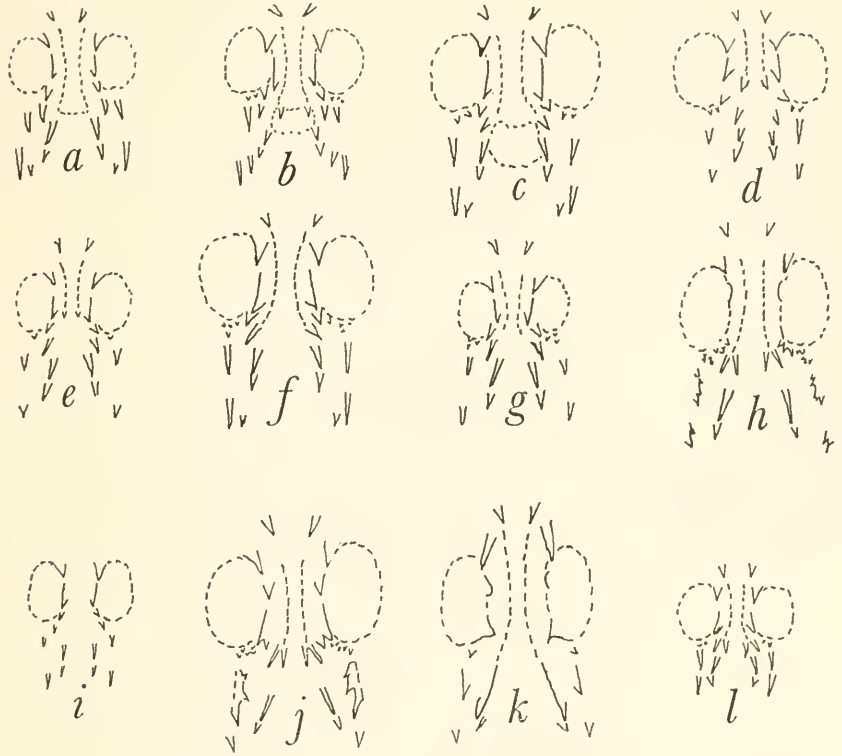

FIGURE 138.—Diagram of cranial spines on certain species of scorpaenid fishes: *a*, *Sebastapistes bynoensis* (Richardson); *b*, *S. corallicola* Jenkins; *c*, *S. mcadamsi* (Fowler); *d*, *Scorpaenodes parvipinnis* (Garrett); *e*, *S. kelloggi* (Jenkins); *f*, *Sebastapistes albobrunnea* (Günther); *g*, *Scorpaenodes guamensis* (Quoy and Gaimard); *h*, *Pterois radiata* Cuvier and Valenciennes; *i*, *Hypomacrus brocki*, new species; *j*, *Pterois antennata* (Bloch); *k*, *P. lunulata* Temminck and Schlegel; *l*, *Brachirus biocellatus* (Fowler).

last dorsal spine 1.1 and in longest dorsal spine 1.3; length of first anal spine in second 1.8 to 1.9; pelvics reach to anus.

This species is characterized by the long preorbital barbel and the two ocellate spots in the soft dorsal fin; body and head, except maxillary and underside of head, covered with ctenoid scales; underside of head anteriorly with spinules; tongue rather long; palatine teeth absent; concave notch at tip of premaxillaries into which fits the tip of lower jaw.

Color in alcohol.—Ground color whitish with blackish vertical bars, one from dorsal surface of snout to preorbital cirrus, one between preocular spines, one from occiput to dorsal origin ventrally across operculum and pectoral base to pelvic insertion, one from middle of spinous dorsal to abdomen, one from soft dorsal base to anal, one across base of caudal fin followed by a pale bar; pectoral and caudal

fins barred with blackish; pelvic fins black, with two pale areas in central part of soft rays, margins white; anal fin blackish broken by a white bar across center, margin pale; posterior margin of soft dorsal fin with two distinct black ocellate spots.

Ecology.—This characteristic species was taken in an abundant growth of corals in about 6 to 25 feet of water where the current was strong and wave action rugged.

FIGURE 139.—*Brachirus biocellatus* (Fowler), holotype, USNM 98894, from the Philippines, after Fowler.

Remarks.—During the course of this study we have examined several specimens of *Brachirus* from various parts of the Indo-Pacific area and are able to present new data on certain species before us.

Brachirus zebra as understood by us has the general color pattern shown by Bleeker (Atlas ichthyologique . . ., pl. 411, fig. 1, 1862), in whose figure one of the most characteristic color marks is the last dark bar across the caudal peduncle, with a middle projection extending from it to the base of the middle caudal fin rays; the supraorbital tentacle either long and barred or short, as in some of our specimens. In our specimens under USNM 26630 (Fiji Island), 122853 (New Hebrides), and 123367 (Okinawa), there are XIII,10 dorsal rays, III,6 anal, and 16 or 17 pectoral rays. After examining the two types of *Dendrochirus sauselele* Jordan and Seale, USNM 51760, and finding color pattern and fin rays the same as in *zebra*, we are of the opinion that *sauselele* is a synonym of *zebra* and herewith

correct the identification made by me (U.S. Nat. Mus. Bull. 180, p. 173) as *sauselele*.

Another species, *Brachirus brachypterus*, figured by Bleeker (Atlas ichthyologique . . . , pl. 415, fig. 3, p. 862), has a color pattern closely resembling specimens before us and with the same number of dorsal rays, XIII,9, and anal rays, III,5. Bleeker's figure shows the pectoral fin crossed with several bars. Our specimens have these bars, and, in addition, the upper rays are blackish. The pelvics, too, are blackish, with about 3 bars across them; there is a dark brown bar across the breast (usually interrupted in *zebra*). Our examination of the types of *Dendrochirus chloreus* Jenkins, USNM 50701 and 126089 from Honolulu, and *Dendrochirus hudsoni* Jordan and Evermann, USNM 50652, appear to be the same species as that figured by Bleeker as *brachypterus*. We identify USNM 108481, from Oahu, and 109367, from Honolulu, as *brachypterus*.

Peterois barberi Steindachner is undoubtedly the same species as *brachypterus*.

Subfamily SCORPAENINAE

Genus SEBASTAPISTES Gill

Sebastapistes GILL *in* Streets, U.S. Nat. Mus. Bull. 7, p. 62, 1877 (type species, *Sebastapistes strongia* (Cuvier and Valenciennes)=*Sebastapistes coniorta* Jenkins).

Scorpaena Linnaeus (Systema naturae, ed. 10, p. 266, 1758; type species, *Scorpaena porcus* Linnaeus) is distinguished by having cycloid scales, as opposed to the ctenoid scales in *Sebastapistes*, *Scorpaenopsis*, *Scorpaennodes*, and *Hypomacrus*.

SEBASTAPISTES ALBOBRUNNEA (Günther)

PLATE 128,A; FIGURE 138,f

Scorpaena albo-brunnea GÜNTHER, Journ. Mus. Godeffroy, vols. 2–3, pts. 5–6, p. 77, 1874 (type locality, Pelew Islands).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 41 specimens, 25 to 64 mm. in standard length.
Rongelap Atoll: 3 stations, 19 specimens, 22 to 63 mm.
Eniwetok Atoll: 2 stations, 2 specimens, 55 and 56 mm.
Kwajalein Atoll: 2 specimens, 44 and 45 mm.

Description.—Dorsal rays XII,9, rarely XII,10; anal III,5; pectoral i,4 to 6,ix to xi, usually i,5,x; pelvics always I,5 and branched caudal 6+5; number of vertical scale rows from upper edge of gill opening to midbase of caudal fin 49 to 52; cranial spines arranged as in figure 138,*f* in the interorbital region.

Depth 2.6 to 2.7; head 2.2 to 2.3; both in standard length. Snout

2.9 to 3.1; eye 3.2 to 3.8; postorbital part of head 2.2 to 2.4; least depth of caudal peduncle 4.2 to 4.5; longest ray of pectoral fin 1.7; longest dorsal spine 2.1; all in length of head. Least width of bony interorbital 2.2 to 2.5 in eye; least depth of caudal peduncle in its length 1.7 to 1.8; next to last dorsal spine in last dorsal spine 1.4 to 1.7 and in longest dorsal spine 2.0 to 2.2; length of first anal spine in second 1.6 to 1.8; pelvics reach considerably past the vent, sometimes to anal origin.

This species lacks cirri on cranial spines, on lateral line pores, and elsewhere except on top of nasal spine. The eye, lips, maxillaries, interorbital space, snout, and chin are naked. Scales extend out from bases of soft dorsal and anal rays a distance of from 2 or 3 scales to not over a fourth to a third the length of pectoral rays out from their bases. Palatine teeth present; upper jaw without notable concavity at symphysis; spines at base of caudal fin not exposed.

Color in alcohol.—General ground color light brownish, broken into irregular bars by large whitish blotches. The most regularly distinct bars are as follows: one crossing the caudal peduncle and one from the soft dorsal fin to anal fin, another less distinct extending to area of vent; usually a pale bar crosses base of caudal fin, then distal two-thirds of that fin pale dusky; usually head and trunk finely speckled with white.

Color when alive.—All areas white in alcohol are lemon yellow and dark bars reddish brown.

Ecology.—This species occurs in any situation where there is ample protection in crevices in the corals or among rather large growths of coral and algae.

Remarks.—After a careful examination of the type of *Sebastapistes coniorta* Jenkins, I am convinced beyond doubt that *coniorta* of the Hawaiian Islands and *albobrunnea* are distinct species. *S. coniorta* with small brown spots everywhere on head, body, and fins may be recognized at a glance. It is the same species, examined by me, that Streets (p. 62, 1877) reported upon as *Sebastapistes strongia*, USNM 15400.

I have examined the holotype of *Scorpaena aquaba* Fowler, ANSP 72139, and believe it is the same species as *Sebastapistes albobrunnea*.

SEBASTAPISTES MCADAMSI (Fowler)

PLATE 129,B; FIGURE 138,*c*

Scorpaena mcadamsi FOWLER, Proc. U.S. Nat. Mus., vol. 85, p. 60, fig. 24, 1938 (type locality, Philippine Islands).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 5 specimens, 26 to 61 mm. in standard length.
Rongelap Atoll: 4 stations, 10 specimens, 21 to 73 mm.
Eniwetok Atoll: 1 specimen, 59 mm.

Description.—Dorsal rays XII,9; anal III,5; pectoral i or ii,2 or 3,ix to xi, or in the two smaller specimens vi,ix on both sides, rays, apparently, do not branch until adult life; pelvics I,5; caudal fin with 6+5 branched rays; gill rakers on first gill arch about 5+1+6; number of vertical scale rows from upper edge of gill opening to midbase of caudal fin 40 to 43 and pores in lateral line 22 or 23; cranial spines arranged as in figure 138,c in the interorbital region.

Depth 2.6 to 2.7; head 2.3 to 2.4; both in standard length. Snout 3.7 to 3.8; eye 3.2 to 3.7; postorbital part of head 2.1 to 2.3; least depth of caudal peduncle 3.8 to 4.0; longest ray of pectoral fin 1.3 to 1.6; longest dorsal spine 2.2; all in length of head. Least width of bony interorbital in eye 2.1 to 2.2; least depth of caudal peduncle in its length 1.5 to 1.6; next to last dorsal spine in last dorsal spine 1.4 to 1.6 and in longest dorsal spine 1.8 to 1.9; length of first anal spine in second 2.2 to 2.3; pelvics reach notably past anus but not quite to anal fin origin.

This species has its body covered with ctenoid scales, but none occur on the base of the rays of any fin; head has scales behind the orbit and on the operculum, elsewhere it is naked except on dorsal and partly anterior surface of eye. Large dermal flaps or cirri occur on head and on a few lateral line scales; supraocular dermal flap is as broad as long, but usually twice as long as broad, may be nearly as long as diameter of orbit in its greatest development, or only one-fourth diameter of orbit; other large dermal flaps occur regularly on preopercular margin on the posterior preorbital spine, and a smaller one on the maxillary bone near its center posteriorly; second anal spine heavier than and projects a little beyond third; upper jaw with slight concavity at tip and lower jaw with only slight symphyseal enlargement; palatine teeth present; longest dorsal spines and soft rays about equal in length; spines at base of caudal fin not exposed; preorbital has two prominent spines, one directed and slightly curved straight forward, the other directed straight downward but slightly hooked forward.

Color in alcohol.—Six or seven dark bars made up of irregular blotches: first three occur on the spiny dorsal and body below, where they more or less unite; first of these includes the bases of first three spines and below; second includes the fourth to seventh spines, tip of the third, and body below the bases of the fifth to seventh spines; and third bar occurs between eight to eleventh spines, continuing irregularly to region of vent; a pale area occurs below bases of last two dorsal spines and first two soft rays to area of anal fin origin; the next two bars are most distinct and extend from anterior part of soft dorsal to that of anal fin, crossing both fins, leaving distal part of anal and soft dorsal pale; the fifth bar occurs at base of caudal

fin and sixth bar across middle of length of caudal fin; the tips of the caudal fin rays are usually dusky, making up the seventh bar. A broad blotched bar from orbit across cheek and other dark blotches on operculum; interorbital dusky; pectoral more or less barred; pelvics with a bar across middle.

Color when alive.—Dark blotches reddish brown, paler areas olive to whitish.

Ecology.—This species, similar to the other scorpaenid fishes of the northern Marshall Islands, prefers the protection of corals and other crevices in the reefs.

Remarks.—After examining the two paratypes of *S. mcadamsi* Fowler, USNM 99013, I doubt that these are of the same species as the holotype. One lacks the occipital pit and the other has a striking difference in the arrangement of the cranial spines on the dorsal part of the head at rear of orbits. The one with the occipital pit has the rear preorbital spine directed posteriorly instead of downward and curved forward as in the holotype and in all the specimens from the northern Marshall Islands.

SEBASTAPISTES CORALLICOLA Jenkins

PLATE 127,B; FIGURES 138,*b*; 140

Sebastapistes corallicola JENKINS, Bull. U.S. Fish. Comm., vol. 22 (1902), pp. 493–495, fig. 38, 1903 (type locality, Honolulu; holotype examined, USNM 50691).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 33 specimens, 14 to 42 mm. in standard length.
Rongerik Atoll: 3 stations, 12 specimens, 17 to 43 mm.
Rongelap Atoll: 2 stations, 6 specimens, 33 to 53 mm.
Eniwetok Atoll: 2 stations, 3 specimens, 23 to 29 mm.
Guam: 2 lots, 10 specimens, 25 to 53 mm.

Description.—Dorsal rays, XII,9; anal III,5; pectoral i or ii,3 to 5,ix to xi; pelvics I,5; branched caudal 6+5; number of gill rakers on first gill arch about 4+1+7 or 8; number of vertical scale rows from upper edge of gill opening to midbase of caudal fin 41 to 44, and pores 21 to 23; cranial spines in interorbital region arranged as in figure 140.

Depth 2.7 to 3.2; head 2.3 to 2.6; both in standard length. Eye 3.0 to 4.1; postorbital part of head 1.9 to 2.1; least depth of caudal peduncle 3.6 to 3.8; longest ray of pectoral fin 1.3 to 1.4; longest dorsal spine 2.3 to 2.5; all in length of head. Least width of bony interorbital in eye 1.7 to 2.2; least depth of caudal peduncle in its length 1.5 to 1.6; next to last dorsal spine in last dorsal spine 1.2 to 1.5, and in longest dorsal spine 1.7 to 2.0; length of first anal spine in second 1.7 to 2.0; pelvics reach considerably past vent but not quite to anal origin.

This species is covered with ctenoid scales except the head and fins, which are naked; in general, cirri or dermal flaps are feebly developed, though some occur on a few of the cranial spines (supraocular, preorbital, preopercular) and sometimes along lateral line; symphysis of upper jaw without concavity and no symphyseal knob developed at tip of lower jaw; palatine teeth present; longest dorsal spines about equal to length of longest soft rays of that fin; usually no spine is exposed at base of caudal fin.

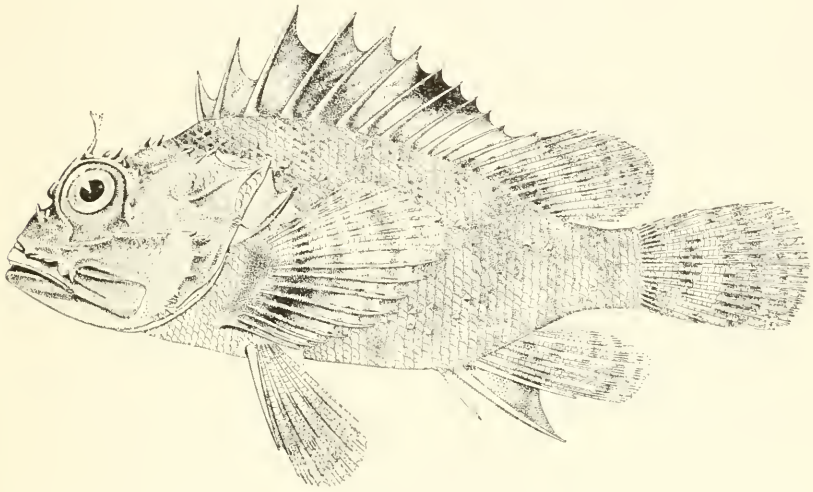

FIGURE 140.—*Sebastapistes corallicola* Jenkins, holotype, USNM 50611, after Jenkins.

Color in alcohol.—Dorsal fin in a large percentage of specimens has a black blotch distally on membranes between the seventh and tenth dorsal spines; this is a characteristic mark. The general color pattern consists of 7 or 8 irregular bars consisting of blotches of varying intensity; first blotch at origin of spiny dorsal, next two from below base of spiny dorsal, fourth bar usually complete and extends from anterior part of dorsal fin rays to near anal origin, fifth, sometimes lacking, extends from posterior tips of dorsal fin across caudal peduncle and includes part of anal fin, sixth most prominent at base of caudal fin rays and includes a little of the caudal peduncle, seventh and eighth occur on caudal fin, one across the central part and one distally, leaving tips of rays white; sides and under parts of head barred or blotched; breast plain pale; paired fins with small blotches more or less forming 2 to 4 bars.

Ecology.—This small scorpaenid appears to prefer the more exposed ocean reef and the lagoon reefs where conditions are more rugged.

Remarks.—In my report on the fishes of the Phoenix and Samoa Islands (U.S. Nat. Mus. Bull. 180, p. 174, 1943), I identified this

species as *S. nuchalis* on the basis of a possible error in Günther's description of the position of the black spot in the spiny dorsal fin. Two of our specimens were sent to the British Museum for comparison with Günther's types. We were informed by Miss Trewavas that our two specimens "are very similar to *nuchalis* except in color pattern. The dark blotch on dorsal spines 3 to 5 is still conspicuous. There is also a somewhat fainter blotch centered on the ninth spine, like that centered on the eighth and ninth in our specimens. I don't know how important color markings are in scorpaenids, but those on the head cannot be very rigid, because in the type of *S. nuchalis* the left cheek is densely pigmented, the right cheek pale; the left opercular and postorbital region are pale, the right dark."

Since our specimens appear to lack the dorsal spot between dorsal spines III to V, we are tentatively using the name *S. corallicola.*

SEBASTAPISTES BYNOENSIS (Richardson)

FIGURE 138,*a*; 141

Scorpaena bynoensis RICHARDSON, *in* Zoology of the voyage of H.M.S. *Erebus* and *Terror* . . . , vol. 2, Ichthyology, p. 22, pl. 14, figs. 3–5, 1845 (type locality, northwest coast, Australia).

Scorpaena bakeri SEALE, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 120, 1901 (type locality, Guam).

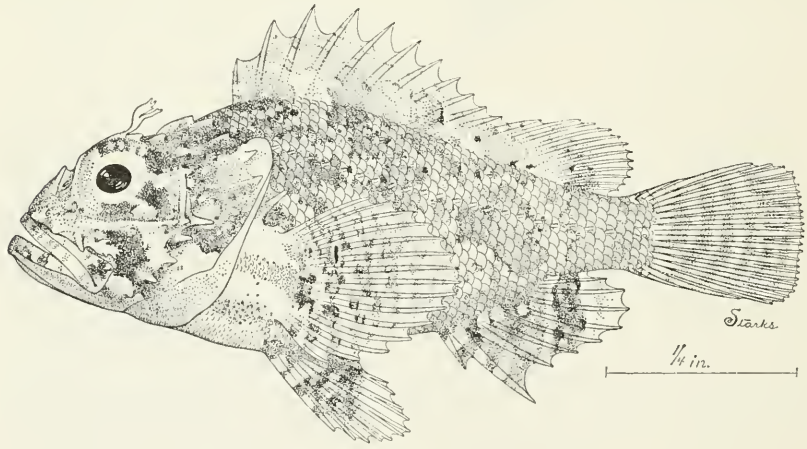

FIGURE 141.—*Sebastapistes bynoensis* (Richardson), USNM 52053, from the Philippines, after Jordan and Seale.

SPECIMENS STUDIED

Rongelap Atoll: 1 station, 1 specimen, 23 mm. in standard length.
Guam: 2 lots, 2 specimens, 29 to 39 mm.

Description.—Dorsal rays XIII,8 or 9, usually 9; anal III,5; pectoral xiv to xvi on young specimens; pelvics I,5; branched caudal 6+5;

vertical scale rows from upper edge of gill opening to midbase of caudal fin 40 to 42, and pores 20 to 21.

Depth 2.7 to 2.8; head 2.4 to 2.6; both in standard length. Snout 3.3 to 3.7; eye 3.5 to 3.7; postorbital part of head 2.3 to 2.3; least depth of caudal peduncle 3.8 to 4.0; longest ray of pectoral fin 1.3 to 1.4; longest dorsal spine 2.2 to 2.3; all in length of head. Least width of bony interorbital 2.0 to 2.2 in eye; least depth of caudal peduncle in its length 1.6 to 1.8; next to last dorsal spine in last dorsal spine 1.1 to 1.3 and in longest dorsal spine 1.6 to 1.8; length of first anal spine in second 1.8 to 2.0; pelvics reach to or slightly past anus but not to anal origin.

This species has an abundance of dermal cirri on cranial spines and on scales of body; usually supraocular cirrus is well developed, longer than diameter of orbit. Pectoral fin rays do not branch at so small a size as in some of the other related scorpaenid fishes, so that for the specimens herein recorded, no branched rays were noted. Concave notch at tip of upper jaw small or lacking and symphyseal knob at tip of lower jaw very small; spines at base of caudal fin not exposed; palatine teeth present; preorbital bone with one spine pointing forward and one curved aft.

Color in alcohol.—Body, head, and fins mottled with brownish to blackish, with white or pale flecks; most characteristic color marking for this species is white with darkish bars across underside of head.

Remarks.—*S. bynoensis* was a rare species in the northern Marshall Islands and the small specimens recorded herein are not positively identified by us as *S. bynoensis*. *Sebastapistes nivifer* Jordan and Seale, type USNM 52053, appears to be the same as *S. bynoensis*. *S. laotali* Jordan and Seale is a distinct species, lacking the development of the supraocular tentacle but closely related to *S. bynoensis*.

Genus SCORPAENOPSIS Heckel

Scorpaenopsis Heckel, Ann. Wiener Mus., vol. 2, No. 1, p. 158, 1839 (type species, *Scorpaena nesogallica* Cuvier and Valenciennes).

SCORPAENOPSIS GIBBOSA (Bloch and Schneider)

Plate 126,C

Scorpaena gibbosa Bloch and Schneider, Systema ichthyologiae . . . , p. 192, pl. 44, 1801 (type locality, America).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 76 and 110 mm. in standard length.
Rongelap Atoll: 2 stations, 3 specimens, 109 to 148 mm.
Eniwetok Atoll: 2 stations, 2 specimens, 65 and 134 mm.
Guam: 3 lots, 3 specimens, 40 to 85 mm.

Description.—Dorsal rays XII,9; anal III,5; pectoral i,4 or 5,ix to

xiii; caudal with 6+5 branched rays; pelvics I,5; gill rakers about 5+1+8; number of vertical scale rows from upper edge of gill opening to midbase of caudal fin 43 to 45, and 22 to 24 pores in lateral line.

Depth 2.5 to 2.8, head 2.2 to 2.3, both in standard length. Snout 3.2 to 3.3, eye 5.0 to 7.0, postorbital part of head 1.8; least depth of caudal peduncle 3.5 to 3.8, longest ray of pectoral fin 1.5 to 1.6, longest dorsal spine 3.0 to 3.8, all in length of head. Least width of bony interorbital 0.7 to 0.9 in eye; least depth of caudal peduncle in its length 1.4 to 1.5; next to last dorsal spine in last dorsal spine 1.3 to 1.7 and in longest dorsal spine 1.4 to 1.8; length of first anal spine in second 1.9 to 2.1; pelvics reach to or a little past vent but not quite to anal fin origin.

Body covered with ctenoid scales, mostly lacking on head, except on the operculum. Numerous dermal cirri almost everywhere on head and body, but especially well developed on dentary, maxillary, preorbital, preopercle, operculum, along lateral line, and on various body scales; a large dermal cirrus at midbase of caudal fin; second anal spine equal to or a little longer than third, both about same thickness; tip of upper jaw with scarcely any concavity at symphysis, but tip of lower with distinct symphyseal knob projecting slightly beyond profile of snout; palatine teeth absent; a distinct pit below eye; area at anterior part of base of spiny dorsal with a high camel-like hump (composed of muscular tissue that appeared normal); rays of soft dorsal notably longer than dorsal spines; no spines exposed at base of caudal fin; cranial spines exceedingly well developed and becoming many-pointed with increase of age, some serrate in form; preorbital with one spine directed forward and another main spine downward and backward.

Color in alcohol.—Head and trunk generally barred and blotched with blackish and pale areas; a black barlike blotch extends from above pectoral fin base and rear of head dorsally, covering the hump and the dorsal fin from third to fourth or fifth spine; a second prominent blackish irregular bar extends from soft dorsal fin across body, including basal three-fourths of anal fin; base of caudal fin rays blackish, and another dark bar across middle third of caudal fin, with distal fifth of that fin pale; pectoral blotched with blackish, mostly forming two dark irregular bars across it, with tips and center of fin paler; pelvic fins with central area black, distal fifth of margin white; buccal membrane between premaxillary teeth and area inside these teeth at symphysis of upper jaw black with a median white line; axil of pectoral fin with a black spot and sometimes a few additional black dots.

Color when alive.—The most outstanding color mark on this species

was the ocellate black spot surrounded by bright orange on posterior side of pectoral fin and its base.

Ecology.—This species is rather rare, at least in the shallower parts of the reefs where we took most of our specimens. It prefers abundant growths of corals and algae that occur in both the lagoon and ocean reefs.

Remarks.—This species is the only one so far encountered in the northern Marshall Islands that has two spiny points on the nasal bone and the only species with the posterior side of the pectoral fin bright orange.

S. cacopsis Jenkins from Oahu is a species distinct from *S. gibbosa*. *Scorpaena axillaris* Bliss, type MCZ 6028, from Mauritius, differs from *S. gibbosa* in not having the black spot in the oral membrane at the symphysis of the premaxillary between the teeth.

Genus SCORPAENODES Bleeker

Scorpaenodes Bleeker, Nat. Tijschr. Nederl.-Indië, vol. 13, p. 371, 1857 (type species, *Scorpaena polylepis* Bleeker = *S. guamensis* Quoy and Gaimard).

SCORPAENODES KELLOGGI (Jenkins)

Plate 127,C; Figures 138,*e*; 142

Sebastopsis kelloggi Jenkins, Bull. U.S. Bur. Fish., vol. 22 (1902), p. 492, fig. 37, 1903 (type locality, reef at Honolulu; holotype USNM 50694).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 13 specimens, 17 to 35 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 24 mm.
Rongelap Atoll: 1 station, 1 specimen, 26 mm.

Description.—Dorsal rays XIII,8; anal III,5; pectoral ii or iii,5 or 6,viii or ix; branched caudal 6+5; pelvics I,5; vertical scale rows from upper edge of gill opening to midbase of caudal fin 30 or 31; pores in lateral line about 20 or 21.

Depth 3.0 to 3.2; head 2.5 to 2.6; both in standard length. Snout 3.8 to 4.4; eye 3.0 to 3.3; postorbital part of head 2.0 to 2.2; least depth of caudal peduncle 3.5 to 3.7; longest ray of pectoral fin 1.4; longest dorsal spine 3.5 to 4.2; all in length of head. Least width of bony interorbital 1.8 to 2.1 in eye; least depth of caudal peduncle in its length 1.5 to 1.7; next to last dorsal spine in last dorsal spine 1.3 to 1.5 and in longest dorsal spine 1.8; length of first anal spine 2.0 in second; pelvics reach to or not quite to anus.

This species has small dermal cirri on some of the cranial spines, the one on the supraocular about equal to diameter of pupil; scales ctenoid on body and on head except snout and under side of head, maxillary probably naked too; palatine teeth absent; preorbital bone

without the usual spines along the lower edge, rounded projections at places where the two spines usually occur; a short spine on interorbital ridge; concave notch at tip of premaxillary and symphysial knob at tip of lower jaw both small.

Color in alcohol.—Brownish with the usual tendency for bars, one at front of spiny dorsal, another at rear of that fin, a third below soft dorsal, next at base of caudal fin and on caudal peduncle, with the caudal fin barred; pelvics blackish with outer ray pale; pectoral with basal central part of fin blackish, rest of fin pale or barred; first bar has tendency to form a blackish basal spot on the first to fifth dorsal spines.

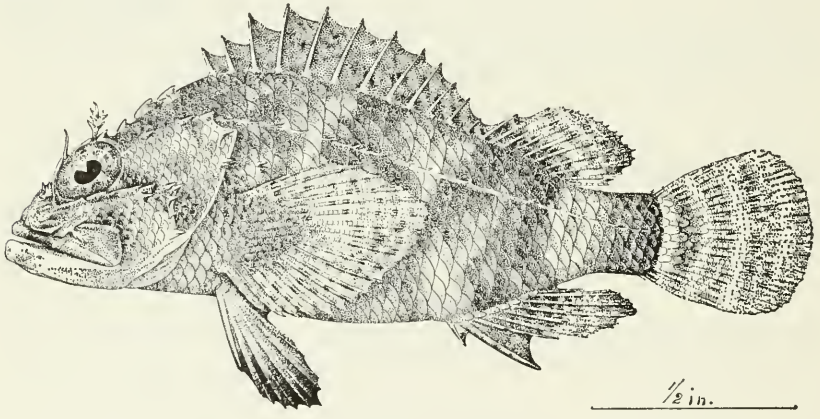

FIGURE 142.—*Scorpaenodes kelloggi* (Jenkins), holotype, USNM 50694, from Honolulu

Remarks.—There are some minor differences in color between specimens from the Hawaiian Islands and the two smaller ones from the Marshall Islands, but these differences may be the result of age and size. Until larger series for comparison are available, we propose to consider the Marshall Island material as *S. kelloggi*. This species has the fewest number of scales of this kind of fish examined.

SCORPAENODES GUAMENSIS (Quoy andGaimard)

PLATE 125,C; FIGURE 138,*g*

Scorpaena guamensis QUOY and GAIMARD, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 326, 1824 (type locality, Guam).

Scorpaena polylepis BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 173, 1851 (type locality, Sumatra).

Scorpaena erinacea GARMAN, Bull. Mus. Comp. Zool., vol. 39, p. 231, pl. 1, fig. 2, 1903 (type locality, Fiji Islands; holotype studied, MCZ 28313).

Sebastopsis scaber RAMSAY and OGILBY, Rec. Australian Mus., vol. 9, No. 3, p. 387, pl. 13, fig. 2, 1913 (type locality, Sydney and Newcastle, New South Wales; Lord Howe Island).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 14 specimens, 20 to 59 mm. in standard length.
Eniwetok Atoll: 3 stations, 22 specimens, 29 to 65 mm.
Rongelap Atoll: 4 stations, 13 specimens, 18 to 64 mm.
Rongerik Atoll: 3 stations, 9 specimens, 36 to 63 mm.
Guam: 11 lots, 22 specimens, 23 to 88 mm.
Rota Island: 3 specimens, 34 to 40 mm.
Saipan: 1 specimen, 14 mm.

Description.—Dorsal rays usually XIII,8, rarely XIV,7; anal III,5, rarely III,4; pectoral i to iii,3 to 6,ix to xii; pelvics always I,5; branched caudal 6+5; number of gill rakers on first gill arch 5 or 6+1+6 or 7; number of vertical scale rows from upper edge of gill opening to mid-base of caudal fin 41 to 47; cranial spines arranged as in figure 138,*g* in the interorbital-occipital region.

Depth 2.7 to 3; head about 2.3; both in standard length. Snout 4 to 4.5; eye 3.3 to 3.4; postorbital part of head 2.1 to 2.2; least depth of caudal peduncle 3.7 to 3.8; longest ray of pectoral fin 1.3 to 1.4; longest dorsal spine 2.2 to 2.5; all in length of head. Least width of bony interorbital 1.9 to 2 in eye; least depth of caudal peduncle in its length 1.3 to 1.5; next to last dorsal spine in last dorsal spine 1.1 to 1.2 and in longest dorsal spine 1.6 to 1.9; length of first anal spine in second about 1.1 on breeding males and about 2 to 2.6 on females; pelvics reach to or slightly past vent.

This species is exceedingly scaly. Fine ctenoid scales occurring around the eye, on preorbital, top of snout, about a third the way out on soft dorsal and anal fins, and nearly half way out the pectoral fins; lower jaw, chin, maxillary, and lips naked; cirri occur on tips of cranial spines and on lateral line pores. Palatine teeth absent.

Color in alcohol.—Head, trunk, and fins everywhere blotched and speckled with brown; caudal fin usually abruptly but slightly paler than caudal peduncle and barred with brown; dark brown to blackish blotch occupying most of opercle; soft rays of pelvics blackish or dark brownish, contrasting with paler brown or white pelvic spine; on a specimen 20 mm. in length, a jet black bar occurs across pectoral fin just beyond and including edge of basally scaled area.

Ecology.—This species, one of the most abundant small scorpaenid fishes on the reefs, occurs wherever adequate protection is afforded by crevices or coral and algal growths.

Remarks.—The adult breeding males appear to be distinguishable from adult females by having the first anal spine nearly as long as the second, whereas in females and immature the first spine is much shorter than the second. This small species reaches sexual maturity at a length of 50 to 65 mm.

SCORPAENODES PARVIPINNIS (Garrett)

PLATE 129,C; FIGURE 138,*d*

Scorpaena parvipinnis GARRETT, Proc. California Acad. Sci., 1863, p. 105 (type locality, Hawaiian Islands).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 7 specimens, 61 to 75 mm. in standard length.
Rongerik Atoll: 3 stations, 4 specimens, 56 to 66 mm.
Kwajalein Atoll: 1 specimen, 46 mm.

Description.—Dorsal rays XIII,9; anal III,5, pectoral i or ii,5 or 6; pelvics I,5; branched caudal 6+5; gill rakers on first gill arch about 5+1+7; number of vertical scale rows from upper edge gill opening to midbase of caudal fin 49 or 50 and pores 23 or 24; cranial spines arranged as in figure 138,*d* in the interorbital region.

Depth 2.8 to 3.0; head 2.3; both in standard length. Snout 3.3 to 3.5; eye 3.2 to 3.6; postorbital part of head 2.1 to 2.4; least depth of caudal peduncle 3.2 to 4.0; longest ray of pectoral fin 1.7 to 1.8; longest dorsal spine 3.9 to 4.0; all in length of head.

Least width of bony interorbital 1.7 to 1.8 in eye; least depth of caudal peduncle in its length 1.4 to 1.6; next to last dorsal spine in last dorsal spine 1.3 to 1.5 and in longest dorsal spine 1.5 to 1.8; length of first anal spine in second 1.9 to 2.3; pelvics reach two-thirds to three-fourths way to vent.

This species has strongly ctenoid scales on bases and a quarter to half the way out on dorsal, anal, pectoral, and pelvic rays and on caudal fin; the whole side of the head, including maxillaries, are finely scaled. Lips posteriorly and dentaries on under side of head are naked. Cirri on scales of body, some along pores of lateral line, and others on head; those on cranial spines short, mostly simple. Upper jaw with concavity at symphysis and lower jaw with symphyseal knob that fits into it; palatine teeth absent; dorsal spines shorter than soft dorsal fin rays; usually four spines exposed at dorsal base of caudal fin.

Color in alcohol.—Ground color pale with 4 or 5 pale brownish bars; first two irregular and broken, represented by a brownish blotch on back below bases of second to fourth dorsal spines; the next similar but under fifth to sixth or seventh dorsal spine; third and fourth wide, beginning at base of about eighth dorsal spine and continuing to middle of soft dorsal fin, these two bars separated by a white V-shaped blotch including the next to last dorsal spine; last bar extends across base of caudal fin. In general, pectorals, pelvics, dorsal, and caudal fins with dark spots mostly arranged to form bars; body and head sometimes with numerous small brownish blotches; a pair of somewhat prominent dark spots between bases of postfrontal and parietal spines; usually radiating out from orbit are irregular

dark bars, one forward below nostrils to lower lip, and two across suborbital stay; upper and lower lips barred with dark spots.

Color when alive.—Specks on paired, anal, and caudal fins pink; lower parts of these fins pink; spots on dorsal fin dark orange.

Ecology.—*Scorpaena parvipinnis* is one of the rare species in the areas searched by us. It hides in crevices among the coral.

Genus HYPOMACRUS Evermann and Seale

Hypomacrus Evermann and Seale, Bull U.S. Bur. Fish., vol. 26 (1906), p. 101, 1907 (type species, *H. albaiensis* Evermann and Seale, holotype, USNM 55902).

KEY TO THE SPECIES OF HYPOMACRUS

1*a*. Vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin 38 to 43; usually vii, occasionally vi, simple enlarged and elongate pectoral rays in lower part of fin; dorsal rays XIII,9, rarely 8.....**H. albaiensis** [11] Evermann and Seale

1*b*. Vertical scale rows above lateral line from upper edge of gill opening to midbase of caudal fin 29 to 32; vi, simple, enlarged, and elongate lower pectoral fin rays; dorsal rays XII to XIV,7 to 9, usually 8.
H. brocki, new species

J. L. B. Smith (Rhodes Univ., Ichthy. Bull. No. 12, p. 178, 1958) described as new H. *africanus* and H. *minor*. These may represent the same species that are discussed here.

HYPOMACRUS BROCKI, new species

Figure 138,*i*;143

Holotype.—USNM 99782, Talisse Island, Dutch East Indies, November 9, 1909, *Albatross*, 34.5 mm. in standard length.

Paratypes.—USNM 140091, Bikini Atoll, Arji Island, 100 yards off shore, lagoon coral area, depths to 40 feet, poison, August 7, S–46–308, Brock and Herald, 1 specimen, 21.0 mm.; USNM 140228, Rongelap Atoll, Kieshiechi Island, north end, lagoon coral head, depth 20 feet, July 24, S–46–285, Brock and Herald, 1 specimen, 27 mm.; USNM 140090, Rongerik Atoll, Latoback Island, lagoon reef, June 28, S–46–238, Schultz and Herald, 1 specimen, 27.0 mm.; USNM 133076, Philippine Islands, Manila Bay, Limbones Cove, Feb. 8, 1909, *Albatross*, 1 specimen, 33.1 mm.; USNM 136430, North of Celebes, Talisse Island, Nov. 9, 1909, *Albatross*, 1 specimen, 32 mm.; USNM 136438, Celebes region, Buka Buka Island, Gulf of Tomini, Nov. 20, 1909, *Albatross*, 1 specimen, 26 mm.; USNM 133077, Philippine Islands, Gane Road, Gillolo Island, Dec. 1, 1909, *Albatross*, 1 specimen, 29 mm.; USNM 99783, Philippine Islands, Romblon reef, March 26, 1909, *Albatross*, 1 specimen, 38.5 mm.;

[11] Not yet found in the Marshall Islands. Known from numerous lots in the National Collections taken in the Philippine Islands, Borneo, and Celebes.

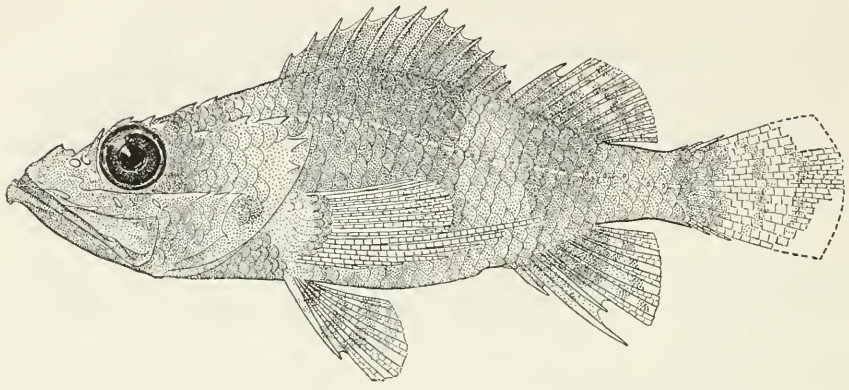

FIGURE 143.—*Hypomacrus brocki*, new species, holotype, USNM 99782, from Talisse Island, Dutch East Indies. Drawn by Dorothea B. Schultz.

Description.—This description is based on holotype and paratypes from the Philippine region and northern Marshall Islands. Detailed measurements were made and these, expressed in thousandths of the

TABLE 124.—*Measurements for species of* Hypomacrus *in thousandths of standard length*

Characters	*brocki*			*albaiensis*
	Paratype (from station S–46–238)	Paratype (from station S–46–308)	Holotype (USNM 99782)	Holotype (USNM 55902)
Standard length in millimeters	27.0	21.0	34.5	49.3
Length of head	444	456	450	448
Greatest depth of body	296	300	290	304
Length of snout	122	129	119	120
Diameter of eye	115	110	113	122
Postorbital length of head	226	233	217	225
Least bony width of interorbital	41	33	55	51
Distance:				
Snout tip to dorsal origin	426	448	420	426
Snout tip to anal origin	720	757	725	779
Snout tip to pelvic insertion	411	438	420	420
Snout tip to pectoral insertion	426	434	418	406
Base last anal ray to midbase of caudal fin	159	167	154	158
Least depth of caudal peduncle	100	100	96	107
Longest:				
Simple ray of pectoral fin	307	338	327	385
Branched ray of pectoral fin	218	214	203	223
Dorsal spine	96	110	107	122
Soft dorsal ray	148	167	130	183
Caudal fin ray	----------	----------	246	264
Length of:				
Second anal spine	178	167	203	203
Third anal spine	148	143	154	150
Base of dorsal fin	510	500	507	497
Base of anal fin	115	124	125	108

standard length, are given in table 124. Counts recorded for both *H. albaiensis* and *H. brocki* are presented in table 125. Dorsal rays XII to XIV,7 to 9; anal III,5; pectoral i or ii,7 or 8,vi; vertical scale rows crossing lateral line 29 to 32, and pores in lateral line 21 or 22; branched caudal fin rays 6+5.

Body and head elongate, with the lower jaw projecting and entering profile; tip of lower jaw with a prominent symphyseal knob that fits into a slight concavity of premaxillary at tip of snout; tongue long and pointed, tip free and elongate; teeth in a band on premaxillaries and dentaries; anterior tip of lower jaw with teeth on raised symphyseal knob; vomer with villiform teeth; no teeth on palatines; body with ctenoid scales; cheeks, operculum, interorbital, and postorbital parts of head scaled; maxillaries, lower jaw, and snout naked; premaxillary processes forming an elevated triangular area on front of snout, with a deep concavity in front of orbits; interorbital space concave; pairs of cranial spines present as follows: preocular, supraocular, postocular, postfrontal, parietal, nuchal, 1 or 2 minute sphenotics, pterotic, 1 posttemporal, humeral, 2 suborbitals, 2 opercular, 3 preopercular, postcleithral; nasal and preorbitals absent. Tips of many cranial spines, some of the pores along lateral line, and numerous scales on

TABLE 125.—*Counts made on two species of* Hypomacrus

Species	Dorsal rays						Anal rays			Pectoral rays					
	XII	XIII	XIV	7	8	9	III	4	5	i	ii	7	8	vi	vii
albaiensis	------	31	------	----	1	30	16	1	15	30	8	9	29	5	33
brocki	1	6	2	1	7	1	9	----	9	7	8	9	6	15	----

	Vertical scale rows crossing lateral line														
	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
albaiensis	------	------	------	----	----	----	----	----	----	1	4	7	8	2	2
brocki	3	2	3	1	----	----	----	----	----	----	----	----	----	----	----

body of certain paratypes with little, dark brownish dermal cirri; anterior and posterior nasal openings large, anterior one with a dermal cirrus; gill membrane attached dorsally a little behind tip of humeral spine; gill rakers rather short, longest at angle of arch, a little shorter than diameter of pupil; seventh dorsal spine usually longest; second anal spine longer and much heavier than third; third or fourth dorsal spine shortest, caudal fin truncate or slightly rounded.

Color in alcohol.—General coloration blackish or brownish, made up of four vertical dark bars, first at origin of dorsal fin past pectoral

base, second from middle of spinous dorsal to abdomen in front of anal fin, third from soft dorsal to anal fin, last across base of caudal fin and slightly on caudal peduncle; spiny dorsal blackish except next to last two spines; basal parts of pectoral, pelvics and anal fins blackish, with distal parts more or less barred; a black spot behind preopercle below upper preopercular spine; head blackish to brownish especially below orbits.

Subfamily SYNANCEIINAE

Genus SYNANCEIA Bloch and Schneider

Synanceia BLOCH and SCHNEIDER, Systema ichthyologie . . ., p. xxxvii, 573, 1801 (type species, *Scorpaena horrida* Linnaeus, misspelled *Syanceja* on p. 194 by Bloch and Schneider).

SYNANCEIA VERRUCOSA Bloch and Schneider

PLATE 129,A

Synanceja verrucosa BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 194, 1801 (type locality, India).

Synanceia thersites SEALE, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 121, 1901 (type locality, Guam); Kendall and Goldsborough, Mus. Comp. Zool., Mem., vol. 26, p. 316, 1911 (Jaluit Atoll, Marshall Islands).

SPECIMEN STUDIED

Eniwetok Atoll: 1 station, 1 specimen, 111 mm. in standard length.
Rota Island: 1 lot, 1 specimen, 50 mm.
Saipan: 1 lot, 1 specimen, 31 mm.

Description.—Dorsal rays XIII,6; anal III,4 or 5; pectoral 18 or 19; pelvics I,5; caudal fin with 4+5 branched rays.

Depth 2.3; head 2.3; both in standard length. Snout 3.3; eye 7.5; postorbital part of head 1.7; least depth of caudal peduncle 3.4; longest ray of pectoral fin 1.3; longest dorsal spine 2.4; all in length of head. Least width of bony interorbital 0.5 in eye; least depth of caudal peduncle in its length 0.7; next to last dorsal spine in last dorsal spine 1.1, and in longest dorsal spine (last) 1.1. Pelvics short, not reaching vent.

This bizarre species has its mouth directed upward, with cirri along lips, and head and trunk everywhere covered with wartlike dermal structures; dorsal spines nearly concealed by thick skin over poison glands; a shallow pit in front of eye and a deeper one behind eye; interorbital deeply pitted.

Color in alcohol.—Mottled pale and dark, tips of dermal "warts" white in Marshall Islands specimen; three dark bars more or less distinct, first below front of spiny dorsal, second at rear of spiny

dorsal, third at tips of soft dorsal; another less distinct bar across distal part of caudal fin, leaving tips pale.

Ecology.—This species lives on the bottom at the base of coral heads and appears to bury itself partially in the sand. Its coloration resembles exactly the bottom on which it occurs, making it very difficult to see. It is one of the most feared of the scorpionfishes because of the excessive development of the poison glands. The poison is delivered along a groove on each side of the dorsal spines.

Remarks.—A striking difference between *Synanceia verrucosa* and other scorpaenid genera examined by us is that all the pectoral fin rays are branched in adults but simple in those 30 mm. and shorter. Although *Synanceia* is one of many specialized genera of scorpionfishes, it is a typical member of the series of scorpaenids and it is on the basis of the deep pits in the cranium, not on the branched pectoral rays, that I believe this genus stands as a subfamily—Synanceiinae.

Family CARACANTHIDAE

By Leonard P. Schultz

Genus CARACANTHUS Krøyer

Caracanthus Krøyer, Naturhist. Tidsskr., ser. 2, vol. 1, p. 267, 1845 (type species, *C. typicus* Krøyer=*Micropus maculatus* Gray; replaces *Micropus* Gray, preoccupied).

KEY TO THE GENUS CARACANTHUS FROM THE NORTHERN MARSHALL ISLANDS

1*a*. Preorbital spine with two spiny knobs on its ventral anterior edge; color plain brownish without black spots; membrane between spiny and soft dorsal not deeply emarginate but connected not less than half way out ..... **C. unipinnus** (Gray)

1*b*. Preorbital spine with a single spiny knob on its ventral anterior edge; color brownish, with black spots on head and body; membrane between spiny and soft dorsal deeply emarginate ..... **C. maculatus** (Gray)

CARACANTHUS UNIPINNUS (Gray)

Plate 128,C

Micropus unipinnus Gray, Zool. Misc., p. 20, 1831 (type locality, Pacific).

SPECIMENS STUDIED

Bikini Atoll: 16 stations, 75 specimens, 11 to 30 mm. in standard length.
Rongerik Atoll: 2 stations, 13 specimens, 13 to 23 mm.
Rongelap Atoll: 7 stations, 47 specimens, 12 to 30 mm.
Eniwetok Atoll: 2 specimens, 19 to 22 mm.
Likiep Atoll: 1 lot, Univ. Washington, 2 specimens, 28 to 33 mm.
Saipan: 1 lot, 2 specimens, 18 to 25 mm.

Description.—Dorsal rays VII,12 or 13; anal II,11 or 12 (usually 12); pectoral vi+vii; branched caudal 6 or 7+7; pelvics I,3; gill rakers about7+1+11.

Greatest depth 1.8; head 1.3 to 1.8; both in standard length. Snout 3.7 to 3.8; eye 3.6 to 4.3; snout tip to rear edge of maxillary 2.0 to 2.1; postorbital length of head 1.7 to 1.8; longest dorsal spine 2.9 to 3.0; longest soft ray of dorsal 2.1 to 2.2, of anal 3.0 to 4.2, of pectoral 2.1 to 2.2, and of caudal fin 1.4 to 1.5; least depth of caudal peduncle 2.7 to 2.8; all in length of head to fleshy edge of opercle. Least width of bony interorbital in eye 1.7 to 1.9.

Body greatly compressed, everywhere profusely covered with minute papillae except on fins and behind pectoral base; profile of head steep, mouth horizontal; preopercle with 5 spines, interopercle with spine; preorbital ending in a strong spine, with 2 spiny knobs on its ventral anterior edge; nostrils, 2 tubular, anterior one slightly longer; teeth in villiform bands in both jaws; vomer and palatines toothless; gill rakers short; membrane between spiny and soft dorsal fin concave but connected more than halfway out from base of first soft ray.

Color in alcohol.—Plain brownish.

Ecology.—This species, living largely in the coral *Acropora*, is abundant on reefs of lagoons or ocean sides where wave action is strong or surf conditions occur. *Caracanthus* will remain in the coral after it is broken loose and may be removed on shore by cracking the coral growth in fragments.

CARACANTHUS MACULATUS (Gray)

PLATE 128,B

Micropus maculatus GRAY, Zool. Misc., p. 20, 1831 (type locality, seas of Owaihi and Hao).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 16 specimens, 24 to 38 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 21 mm.
Rongelap Atoll: 1 station, 6 specimens, 30 to 40 mm.
Kwajalein Atoll: 1 station, 4 specimens, 21 to 28 mm.

Description.—Dorsal rays VII or VIII,12 or 13 usually VIII,12; anal II,11 or 12; pectoral vi or vii+vii or viii (enlarged); branched caudal usually 6 or 7+7; pelvics I,3; gill rakers about 7+1+12.

Greatest depth 1.7; head 2.0 to 2.3; both in standard length. Snout 3.6 to 4.0; eye 4.0 to 4.2; snout tip to rear edge of maxillary 2.2 to 2.5; postorbital length of head 1.6 to 1.7; longest dorsal spine, fourth, 3.7 to 3.8; longest soft ray of dorsal 2.8 to 2.9, of anal 3.8 to 4.2, of pectoral 2.2 to 2.6, of caudal 1.7 to 1.9; least depth of caudal peduncle 3.1 to 3.5; all in length of head to fleshy edge of opercle. Least bony width of interorbital in eye 1.7 to 2.1.

Body greatly compressed, covered profusely with papillae, these lacking on all fins; profile of head steep, mouth nearly horizontal; preopercle with 5 spines, interopercle with a strong spine; preorbital

ending posteriorly in a strong spine and on its ventral, anterior edge a small spiny knob; 2 nostrils, anterior one projecting more than posterior, both tubular; teeth in villiform band in both jaws, absent on vomer and palatines; gill rakers short; membrane between spiny and soft dorsal fin deeply emarginate, connected less than halfway out from base of first soft ray.

Color in alcohol.—Brownish with small black dots everywhere except on fin rays, breast, and ventral parts of head.

Ecology.—This species was most frequently encountered in the coral *Acropora*, living in surf or near surf conditions or where the wave action was generally strong. It was taken from ocean reefs in the lagoon and from the channel reefs.

Family PLATYCEPHALIDAE: Flatheads

By Leonard P. Schultz

Identification of species referable to this family is extremely difficult because there are numerous names available without adequate figures and descriptions, especially of the cranial ridges and spines, also lacking are important counts of scales and fin rays. To help clarify the different groups of flatheads, a tentative key to genera was attempted. This should be used with caution since some of the species, especially those of Whitley's genera, were not available as specimens.

Since preparing the manuscript on this family, Matsubara and Ochiai (Mem. Coll. Agric. Kyoto Univ., No. 68, pp. 1–109, figs. 1–33, pls. 1–3, 1955) have revised the Japanese species and presented a key to genera. Their study, like mine, was handicapped by not having specimens of the type species of numerous genera, and this has resulted, for them as for me, in unsatisfactory definitions of some of the genera. In general, these authors have recognized as valid several genera that I have placed as synonyms of other genera, and they name one new genus, *Kumococius*, with *Insidiator detrusus* Jordan and Seale as the type species. In my key, *Kumococius* traces down to *Thysanophrys*.

Matsubara and Ochiai illustrate the "iris lappet," otherwise known as the umbraculum, as being different in each of the eight genera recognized, but very similar for each species in each genus. It is very similar in all the three species of *Thysanophrys* herein described. This organ has the ability to expand and contract, much like the iris of our eyes. The umbraculum appears to be used as a sun shade to be adjusted as required in the bright light and sandy habitat where flatheads live.

TABLE 126.—*Counts and measurements for some species of* Platycephalidae *from the northern Marshall Islands*

Genera and species	Vertical scale rows																	Pores in lateral line				
	Above lateral line								Below lateral line													
	53 54	55 56	57 58	59 60	61 62	63 64	65 66	67 68	67 68	69 70	71 72	73 74	75 76	77 78	79 80	81 82	83 84	85 86	51	52	53	54	55
Thysanophrys																							
chiltonae	5	2	2											1	3	3	1			3	7	2	3
papillolabium	1	5	2	2	1				1	3	4	1	1	2	1				3	4	1	1	
arenicola		1		3	3	4						1	1	1	3	3	2	1	3	7	4	1	
Wakiyus																							
welanderi								1					1									1	

TABLE 126.—*Counts and measurements for some species of* Platycephalidae *from the northern Marshall Islands*—Continued

	Fin rays																						Total pectoral rays			
	Dorsal					Anal			Pectoral																	
	VIII	IX	10	11	12	11	12	13	i	ii	iii	10	11	12	13	14	15	16	iv	v	vi	vii	viii	19	20	21	22
Thysanophrys																											
chiltonae	4	6	-----	8	2	2	8	-----	2	8	-----	1	-----	3	2	3	1	-----	-----	5	4	1	-----	1	4	4	1
papillolabium	-----	13	1	11	1	-----	12	-----	2	10	-----	-----	-----	-----	3	7	2	-----	-----	8	4	-----	-----	-----	1	9	2
arenicola	-----	12	-----	-----	12	-----	11	1	15	4	1	-----	-----	1	1	3	12	3	4	12	4	-----	-----	-----	-----	19	1
Wakiyus																											
welanderi	-----	1	-----	1	-----	1	-----	-----	-----	2	-----	-----	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	-----	2

	Scales from anal fin origin to lateral line					Scales from soft dorsal fin origin to lateral line				Scales bearing spines at anterior part of lateral line				
	13	14	15	16	17	5	6	7	8	1	2	3	4	5
Thysanophrys														
chiltonae	-----	1	1	5	1	3	5	-----	-----	-----	5	7	-----	-----
papillolabium	1	5	5	1	-----	-----	5	7	-----	2	13	-----	-----	-----
arenicola	-----	-----	2	6	3	-----	2	5	5	4	7	1	-----	-----
Wakiyus														
welanderi	-----	1	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1	1

We are following the names adopted for the cranial ridges and spines of the Scorpaenidae (see figs. 136, 137).

Counts made on the Marshall Islands specimens are recorded in table 126. The counts of the soft rays, especially of the pectorals, where branched and unbranched rays are separated, are of little value since some of the simple rays become branched in the large fish, whereas they are simple in the small ones.

Dr. L. F. de Beaufort (Proc. Nat. Inst. Sci. India, vol. 22, B, No. 2, pp. 83–85, fig. 1,A, 1957) described as new *Platycephalus horai*, from off New Guinea. I am unable to place it generically in the following key.

KEY TO THE GENERA OF PLATYCEPHALIDAE

1*a*. Vomerine teeth continuous across head of the bone, connecting lateral patches; palatine teeth in a single series or nearly so; premaxillary patch of teeth with a few caninelike teeth along inner edge near symphysis; spines and ridges on head low, not notably prominent; cheek bicarinate; two strong preopercular spines, lower one usually strongest and longest; only one opercular spine; no antrorse spine on preopercle----------**Platycephalus** [12] Bloch

1*b*. Vomerine teeth in two villiform patches separated mesially by a deep edentulous furrow; palatines usually in a narrow to broad villiform band; premaxillary without canines; ridges and spines of head prominent, the upper preopercular spine usually strongest and longest.

2*a*. Two opercular spines and 2 to 6 preopercular spines at lower posterior angle; gill rakers 1+1+3 to 5 developed as distinct elongate projections.

3*a*. Suborbital ridge finely serrate along its entire length.

4*a*. Ridge of lower opercular spine not finely serrate, but ending in a spine; cheek unicarinate.

5*a*. Preopercle with a strong antrorse spine on lower margin; opercular margin without a free dermal flap.

Rogadius [13] Jordan and Richardson

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[12] *Platycephalus* Bloch, Naturgeschichte der auslandischen Fische, vol. 9, p. 96, 1795 (type species, *Platycephalus spathula* Bloch = *Callionymus indicus* Linnaeus).

Calliomorus Lacepède, Histoire naturelle des poissons, vol. 2, p. 343, 1800 (type species, *Platycephalus indicus* Linnaeus).

Neoplatycephalus Castelnau, Proc. Zool. Acclim. Soc. Victoria, vol. 1, p. 87, 1872 (type species, *Neoplatycephalus grandis* Castelnau).

Colefazia Whitley, Rec. Australian Mus., vol. 19, no. 4, p. 249, 1935 (type species, *Platycephalus macrodon* Ogilby).

Trudis Whitley, Australian Zool., vol. 6, no. 4, p. 327, 1931 (type species, *Platycephalus bassensis* Cuvier and Valenciennes).

Longitrudis Whitley, Australian Zool., vol. 6, no. 4, p. 1931 (type species, *Platycephalus longispinis* Macleay).

Planiprora Whitley, Australlan Zool., vol. 6, no. 4, p. 327, 1931 (type species *Platycephalus fuscus* Cuvier and Valenciennes).

Cacumen Whitley, Australian Zool., vol. 6, no. 4, p. 326, 1931 (type species, *Platycephalus speculator* Klunzinger).

Cumbel Whitley, Proc. Roy. Zool. Soc. New South Wales 1950–51, p. 32, 1952 (type species, *Platycephalus haackei* Steindachner).

[13] *Rogadius* Jordan and Richardson, Proc. U.S. Nat. Mus., vol. 33, p. 630, 1908 (type species, *Platycephalus asper* Cuvier and Valenciennes).

5*b*. Preopercle without antrorse spine.

6*a*. Preocular normally with a single spine, no serrations; lateral line unarmed, except possibly for first 1 to 3 scales anteriorly. **Onigocia** [14] Jordan and Thompson

6*b*. Preocular with a spine and from one to several additional smaller spines or serrations; lateral line scales with small spines anteriorly---------- **Wakiyus** Jordan and Hubbs

4*b*. Ridge of lower opercular spine distinctly finely serrate; 2 preocular spines; 3 to 6 preopercular spines; cheek unicarinate in young becoming bicarinate as in large adults------ **Sorsogona** [15] Herre

3*b*. Suborbital ridge not finely serrate, with spines or entirely smooth; cheek bicarinate, with an upper and lower angular edge.

7*a*. All minor ridges of head denticulate or granulate; eye without dermal cirrus; opercular margin with a free-tipped dermal flap. **Suggrundus** [16] Whitley

7*b*. Ridges of head devoid of fine denticulations or granulations; eye with or without dermal cirrus; opercular margin with or without a free-tipped dermal flap.

8*a*. All of the lateral line scales with a strong spine. **Grammoplites** [17] Fowler

8*b*. Only first few or anterior part of lateral line scales with or without spines.

9*a*. Teeth all villiform; no canines---------- **Thysanophrys** Ogilby

9*b*. Teeth highly specialized, those of upper jaw caninelike and depressible---------- **Ratabulus** [18] Jordan and Hubbs

2*b*. A single weak opercular spine and a single strong preopercular spine; no antrorse spine on preopercular margin; developed gill rakers about 5+1+13 or 14; body and head very slender, greatest width about 9 or 10 in standard length---------- **Elates** [19] Jordan and Seale

Genus WAKIYUS Jordan and Hubbs

Wakiyus Jordan and Hubbs, Mem. Carnegie Mus., vol. 10, No. 2, p. 286, 1925 (type species, *Platycephalus spinosus* Temminck and Schlegel).

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[14] *Onigocia* Jordan and Thompson, Proc. U.S. Nat. Mus., vol. 46, p. 70, 1913 (type species, *Platycephalus macrolepis* Bleeker).

[15] *Sorsogona* Herre, Notes on fishes in the Zoological Museum of Stanford University: 1. The fishes of the Herre Philippine Expedition of 1931, p. 67, 1934 (type species, *Sorsogona serrulata* Herre= *Platycephalus tuberculatus* Cuvier and Valenciennes; *Insidiator jugosus* McCulloch appears to be large specimens of *P. tuberculatus* that have the lower ridge of suborbital more serrate with increase in size).

[16] *Suggrundus* Whitley, Mem. Queensland Mus., vol. 10, No. 1, p. 26, 1930; preoccupied, replaces *Insidiator* Jordan and Snyder, Proc. U.S. Nat. Mus., vol. 23, 368, 1900 (type species, *Platycephalus rudis* Günther, *in* Report on . . . voyage of H.M.S. *Challenger* . . . 1873–76, Zoology, vol. 1, pt. 6, p. 66, pl. 29, fig. B, 1880 (Japan) = *P. meerdervoortii* Bleeker 1860).

[17] *Grammoplites* Fowler, Journ. Acad. Nat. Sci. Philadelphia, vol. 12, p. 550, 1904 (type species, *Cottus scaber* Linnaeus).

[18] *Ratabulus* Jordan and Hubbs, Mem. Carnegie Mus. vol. 10, No. 2, p. 286, 1925 (type species, *Thysanophrys megacephalus* Tanaka).

[19] *Elates* Jordan and Seale, Bull. U.S. Bur. Fish., vol. 26 (1906), p. 39, 1907 (type species, *Elates thompsoni* Jordan and Seale).

Hyalorhynchus Ogilby, Proc. Roy. Soc. Queensland, vol. 23, p. 118, 1910 (type species, *Hyalorhynchus pellucidus* Ogilby).

WAKIYUS WELANDERI, new species

FIGURE 144

Holotype.—USNM 141008, Rongelap Atoll, Rongelap Island, lagoon coral head near north end, depth 18 feet, July 25, S–46–286, Brock, Herald, and Kohler, standard length 84 mm.

Description.—For the only known specimen, the following counts are recorded: Dorsal I,VIII–i,10; anal 11; pectoral ii,12,viii–ii,12,viii; pelvics I,5; oblique rows of scales above lateral line corresponding to number of pores in lateral line 54; vertical scale rows below lateral line 75; number of scales between lateral line and first dorsal origin 50, between lateral line and soft dorsal origin 6, between lateral line and anal origin 14; gill rakers developed as distinct elongate points 1+1+5.

The following measurements are recorded in thousandths of the standard length, which is 84 mm. Length of head to rear of fleshy operculum 387; snout 119; lengthwise axis of bony orbit 119; greatest depth of body 131; width across body at pelvic insertion 191;

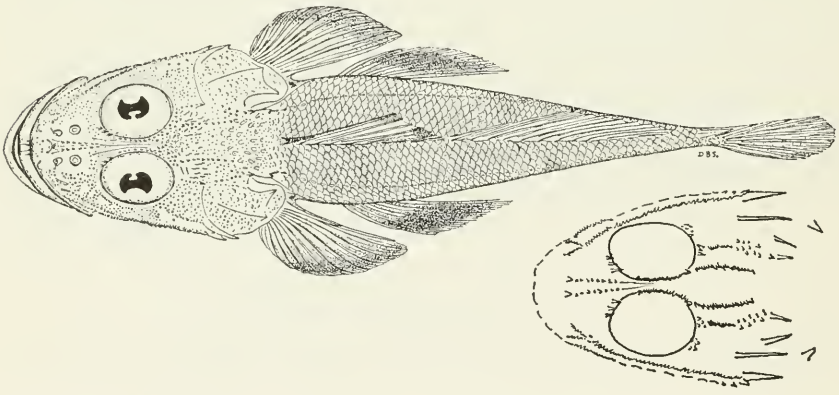

FIGURE 144.—*Wakiyus welanderi*, new species, holotype, USNM 141008, from Rongelap Atoll. Drawn by Dorothea B. Schultz.

snout tip to rear of maxillary 152; least bony width of interorbital 13; postorbital length of head 149; least depth of caudal peduncle 52; length of first dorsal spine 36, and longest or fourth dorsal spine 139; longest soft ray of dorsal 165; pectoral 197, pelvic 274, caudal 220, and anal 119; snout to dorsal origin 375; snout to pelvic insertion 446.

Greatest depth 7; width of body across insertion of pelvics 5; length of head 2.5; all in standard length. Snout 3.2; eye 3.2; least bony interorbital 2.9; postorbital length of head 2.4; longest ray of pectoral 2.0 to 2.1; of pelvic 1.4; and of spiny dorsal 2.8; all in length of head. Least bony width of interorbital in lengthwise axis of eye

diameter 9, and in length of snout 9. Snout 1.2 in postorbital length of head.

Teeth villiform, in narrow bands on both jaws and on vomer; those of palatines in a single or irregular row; tongue edentulous, its tip truncate; lips without minute papillae or fringe; cheek unicarinate; nostrils tubular, anterior one with short dermal flap; dorsal and ventral surfaces of head naked; opercle and preopercle with scales; interorbital very narrow, concave; no pit behind eye; opercular margin without a wide dermal flap; first 6 or 7 scales of lateral line with small to minute spines; no orbital tentacle; preorbital without projecting spine; other ridges and spines of head illustrated in figure 144.

Color in alcohol.—Ground color light tan with traces of 4 or 5 bars across back, as is usual in Platycephalidae; tip of second spine of dorsal blackish, and a blackish blotch between tips of spines IV to VII; traces of bars in soft dorsal; several black pigment cells on membranes submarginally from fifth to eleventh anal rays; lower part of caudal fin darkish basally and again distally; upper distal edge of caudal with traces of bars; margins of both pectoral and of pelvics white, then abruptly blackish, gradually fading basally.

Remarks.—This species belongs to that group of flatheads in which the vomerine patches of teeth are separated by a deep edentulous furrow; suborbital ridge finely serrate; cheek unicarinate; no antrorse spine on preopercle; preocular with more than one spine; lower opercular spine with its ridge smooth, not serrate. We have searched the literature for species with the above characters and find the following species referable to the genus *Wakiyus* as defined above: *Platycephalus oligolepis* Regan, *P. pedimaculus* Regan, *P. grandisquamis* Regan 1908, and *P. grandisquamis* Weber 1913, are homonyms, but probably are the same species and certainly no new name is needed at present. All the above species have from 28 to 31 scales or pores in the lateral line whereas *W. welanderi* differs by having 54. *P. macrocephalus* Weber 1913 may belong in the genus *Wakiyus*; it has 33 scales in the lateral line. As far as we can discover, our new species is the only one known in the genus *Wakiyus* with 54 scales in the lateral line. Since *P. macracanthus* Bleeker has enlarged spines along the suborbital ridge and bicarinate cheek, we are referring it to the genus *Thysanophrys*, after examining several specimens.

The genera *Onigocia* and *Wakiyus* are doubtfully separated on the preocular spines, 1 in *Onigocia* with no spines on the lateral line scales, and 2 or more in *Wakiyus*.

Named *welanderi* in honor of Dr. Arthur D. Welander, School of Fisheries, University of Washington, Seattle, who was at Bikini during the summers 1946–49, studying the radiation effects on living fishes.

Genus THYSANOPHRYS Ogilby

Thysanophrys Ogilby, Proc. Linn. Soc. New South Wales, vol. 23, p. 40, 1898 (type species, *Platycephalus cirronasus* Richardson).

Inegocia Jordan and Thompson, Proc. U.S. Nat. Mus., vol. 46, p. 70, 1913 (type species, *Platycephalus japonicus* Krusenstern; Japan).

Cocius Jordan and Hubbs, Mem. Carnegie Mus., vol. 10, No. 2, p. 286, 1925 (type species, *Platycephalus crocodilus* Tilesius; preoccupied, replaced by *Cociella* Whitley, Australian Nat., p. 243, May 1940; same type species).

Repotrudis Whitley, Mem. Queensland Mus., vol. 10, No. 4, p. 27, 1930 (type species, *Platycephalus macracanthus* Bleeker, Atlas ichthyologique . . ., pl. 419, figs. 1, 1a, 1878).

Leviproa Whitley, Australian Zool., vol. 6, No. 4, p. 327, 1931 (type species, *Platycephalus inops* Jenyns).

Levanaora Whitley, Rec. Australian Mus., vol. 19, No. 1, p. 95, 1933 (type species, *Platycephalus isacanthus* Cuvier and Valenciennes).

Cymbacephalus Fowler, Proc. U.S. Nat. Mus., vol. 85, p. 90, 1938 (type species, *Cymbacephalus nematophthalmus* (Günther)).

Kumococius Matsubara and Ochiai, Mem. Coll. Agric. Kyoto Univ. No. 68, pp. 67, 89, 1955 (type species, *Insidiator detrusus* Jordan and Seale).

KEY TO SPECIES OF THYSANOPHRYS FROM THE NORTHERN MARSHALL ISLANDS

1*a*. Edges of both lips with papillae; least width of bony interorbital space 2 to 2½ in greatest diameter of eye; soft rays of dorsal usually 11. **T. papillolabium**, new species

1*b*. Edges of lips without papillae.

2*a*. Least width of bony interorbital space 5½ to 6 in greatest diameter of eye; soft rays of dorsal 11 or 12 **T. chiltonae**, new species

2*b*. Least width of bony interorbital space 1.1 to 2.0 in greatest diameter of eye; soft rays of dorsal usually 12 **T. arenicola**, new species

The identification of the numerous named species related to *Thysanophrys* as herein defined is difficult because so many of the descriptions lack essential characters that would permit a species to be referred to a genus with certainty. Because of this I have not been able to allocate generically numerous species and thus eliminate them from consideration in the description of the following new species. It has been necessary to search through original descriptions and study figures of the species to find specific characters to compare with my material. The results in some instances hardly justify the considerable time spent in these searches. However, pending a revision of the family Platycephalidae, and in spite of the existing confusion, it appears necessary to describe three new species in this genus.

Bleeker (Revision des espèces insulindiennes du genre *Platycephalus*, Nat. Verh. Koninkl. Akad., vol. 19, pp. 1–31, 1877) in his key to the genus *Platycephalus* recognizes certain groups of species as follows: (1) Teeth on vomer in a continuous transverse band—*P. indicus* Linnaeus; (2) vomerine teeth in two separate groups and vertical scale rows above lateral line 100 or more—*P. nematophthalmus* Günther, *P. quoyi* Bleeker, *P. punctatus* Cuvier and Valenciennes

and *P. scaber* Linnaeus. Our three new species (*T. chiltonae*, *T. papillolabium*, and *T. arenicola*), with vomerine teeth in two patches and vertical scale rows 53 to 64 above lateral line, differ from the above listed species as well as from the following with 85 to 90 vertical rows of scales above lateral line: *P. bosschei* Bleeker, *P. sundaicus* Bleeker, and *P. ransonneti* Steindachner.

Among those species listed by Bleeker with 50 to 75 vertical scale rows above the lateral line, *P. bobossok* Bleeker differs in having a cirrus on the eye, whereas the following have the lateral line with spiny or smooth scales for its entire length: *P. isacanthus* Cuvier and Valenciennes, *P. bataviensis* Bleeker, *P. malayanus* Bleeker, *P. polyodon* Bleeker, and *P. cantori* Bleeker. This leaves but three species listed by Bleeker with the anterior part of the lateral line armed with spines: *P. macracanthus* Bleeker, *P. celebicus* Bleeker, and *P. pristiger* Cuvier and Valenciennes. *P. macracanthus* differs from the three new species, among other characters, in having the preopercular spine greatly elongate, longer than the eye, whereas in the three new species it is less than one eye diameter. *P. pristiger* differs in having the cranial ridges and spines minutely serrated or denticulate. Thus, among those species listed by Bleeker, *P. celebicus* is closest to our three new species, but *P. celebicus* differs in one important character from *T. arenicola* and *T. papillolabium* in having the least bony width of the interorbital space contained 4.0 to 4.5 times in the eye, whereas in the two new species listed the bony interorbital space is contained 2.5 or fewer times. *P. celebicus* is closest to *T. chiltonae* but the former has 13 or 14 anal rays whereas the latter has 11 or 12 anal rays.

Jordan and Richardson (Proc. U.S. Nat. Mus., vol. 33, pp. 629–642, figs. 1–4, 1908) in their review of the Japanese Platycephalidae list the following species as belonging to the genus *Thysanophrys: spinosus* Temminck and Schlegel, *macrolepis* Bleeker, *meerdervoortii* Bleeker, *nematophthalmus* Günther, *longiceps* Cuvier and Valenciennes, *japonicus* Tilesius, *crocodilus* Tilesius, *scaber* Linnaeus, *neglectus* Troschel, *detrusus* Jordan and Seale, *tentaculatus* Rüppell, *malabaricus* Cuvier and Valenciennes, *isacanthus* Cuvier and Valenciennes, *malayanus* Bleeker, *bosschei* Bleeker, *bataviensis* Bleeker, *rodericensis* Cuvier and Valenciennes, *borboniensis* Cuvier and Valenciennes, *bobossok* Bleeker, *sundaicus* Bleeker, *macracanthus* Bleeker, *celebicus* Bleeker, *pristis* Peters, and *cirronasus* Richardson.

Among those species of *Thysanophrys* listed by Jordan and Richardson, we have already separated the following from our three new species: *scaber*, *nematophthalmus*, *bosschei*, *sundaicus*, *bobossok*, *bataviensis*, *malayanus*, *isacanthus*, *macracanthus*, and *celebicus*. The following species listed by Jordan and Richardson have been disposed

of by Bleeker as follows: *malabaricus* is a synonym of *punctatus; neglectus* is a synonym of *scaber;* and *pristis* is a synonym of *celebicus.* Among those species of *Thysanophrys* remaining in the list, *spinosus, macrolepsis, longiceps,* and *tentaculatus* have an ocular cirrus, which is lacking in our three new species. Three other species, *japonicus, meerdervoortii,* and *crocodilus* have more than 70 vertical scale rows above the lateral line, whereas all three new species have fewer than 70. The lateral line is unarmed in *T. cirronasus,* whereas in our new species, the first, second, or third scales have spines. Sauvage (Histoire naturelle des poissons *in* Grandidier, Histoire . . . de Madagascar, vol. 16 (1887), pl. 36, figs. 3, 3a, 4, 4a, 1891) shows in his plate that *P. rodericensis* and *P. borboniensis* have only one spine on the suborbital ridge whereas our three new species have at least 4 spines on the upper ridge of the bony suborbital stay. This leaves one species in Jordan and Richardson's list, *T. detrusus,* which lacks spines on the lateral line; our three new species have a few anteriorly.

In addition to Jordan and Richardson's published list, other species have been described which differ from our three new species. Of these, the following species completely lack spines on the lateral line scales, as opposed to our three new species that have the first to third scales, anteriorly, bearing spines: *Platycephalus platysoma* Zugmayer, *P. inops* Jenyns, *P. speculator* Klünzinger, *Insidiator parilis* McCulloch, *Trudis bassensis westraliae* Whitley, and *Suggrundus hunti* Fowler. The following species have more than the first five scales of the lateral line bearing spines or all of them spiny: *Platycephalus gruveli* Pellegrin, *P. heterolepis* Barnard, *P. cooperi* Regan, *Insidiator jugosus* McCulloch, and *Sorsogona serrulata* Herre. The following species have more than 70 vertical scale rows above the lateral line, whereas our new species have from 53 to 64: *Platycephalus papilloculus* Fowler, *P. marmoratus* Stead, *P.* (*Neoplatycephalus*) *conatus* Waite, *Planiprora melsomi* Whitley, and *Hyalorhynchus pellucidus* Ogilby. The following species, *Platycephalus macrocephalus* Weber, *P. grandisquamus* Regan, *P. grandisquamis* Weber, *P. oligolepis* Regan, *P. pedimacula* Regan, and *Parabembras robinsoni* Regan, have fewer than 45 pores in the lateral line, whereas our three new species have about 50 to 54.

Two other species, *Insidiator harrisi* McCulloch and *I. diversidens* McCulloch, agreeing with our three new species regarding scalation, have denticulate or moderately serrate cranial ridges, whereas our new species have isolated, moderately strong spines. Another species, *Cymbacephalus armatus* Fowler, has the orbital ridge serrate, about 50 vertical scale rows above the lateral line, and 52 vertical scale rows below the lateral line, whereas the three new species have 53 to 64 above, and 67 to 86 vertical scale rows below the lateral line.

Therefore, having determined that none of the numerous species we could find in the literature was the same as the specimens at hand, we conclude that our specimens represent three new species, as described below. Among these new species, one, *T. papillolabium*, has the edges of both lips papillate and differs in that character from all other species in the family Platycephalidae.

THYSANOPHRYS PAPILLOLABIUM, new species

PLATE 130,A; FIGURE 145

Holotype.—USNM 141004, Bikini Atoll, Ocean reef, Cherry Island, Aug. 15, 1946, S–46–361, Herald, standard length, 119 mm.

Paratypes.—USNM 141005, Bikini Atoll, Oruk Island, ocean reef, Aug. 16, 1946, S–46–382, Herald, 1 specimen, 88 mm.; USNM 141002, Bikini Atoll, Eman Island, lagoon reef, July 17, 1947, S–46–405, Schultz, Brock, and Myers, 1 specimen, 128 mm.; USNM 141003, Bikini Atoll, lagoon reef halfway between Bikini and Amen reefs,

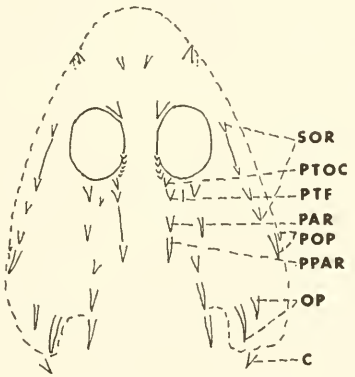

FIGURE 145.—A sketch showing cranial spines of *Thysanophrys papillolabium*, new species, paratype, USNM 141003, from Bikini Atoll. C, cleithral; OP, opercular; PAR, parietal; POP, preopercular; PPAR, posterior parietal; PTF, postfrontal; PTOC, postocular; SOR, suborbital. See figure 147 for names of other spines.

July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 3 specimens, 105 to 145 mm.; USNM 141006, Rongelap Atoll, Arbor Island, ocean reef, June 16, S–46–213, Schultz, 2 specimens, 78 and 83 mm.; USNM 141000, Rongerik Atoll, Bock Island, ocean reef, June 27, 1946, S–46–237, Schultz and Herald, 12 specimens, 66 to 145 mm.; USNM 141001, Rongerik Atoll, Latoback Island, lagoon reef, Aug. 14, 1947, S–1041, Brock, Schultz, and Donaldson, 1 specimen, 78 mm.

The following paratypes were collected by the University of Washington group at Bikini Atoll: Erik Island, July 13, 1948, 2 specimens, 80 and 95 mm.; Ion Island, Aug. 7, 1946, 1 specimen, 140 mm.; Eman Island, Aug. 18, 1947, 4 specimens, 68 to 123 mm.; Bikini-Amen

reef, Aug. 2, 1946, 1 specimen, 61 mm.; Bikini Island, July 24, 1947, 1 specimen, 73 mm.; Enyu Island, July 13, 1946, 1 specimen, 92 mm. From Eniwetok Atoll: Rigili Island, Aug. 10, 1949, Welander, 1 specimen, 80 mm.

Description.—The following counts are recorded for the holotype: Dorsal IX–12; anal 12; pectoral i,15,vi–i,15,v; pelvic I,5; oblique rows of scales above lateral line corresponding with number of pores in lateral line 54; vertical rows of scales below lateral line 75; vertical rows of scales above lateral line 56; scales from soft dorsal origin to lateral line 7; from anal origin to lateral line in a posteriorly directed row 15; developed gill rakers on first arch 1+1+4; branched caudal fin rays 5+5. Additional counts are recorded in table 126.

The following measurements, expressed in thousandths of the standard length, are recorded first for the holotype, then for a paratype. Standard lengths 119 and 78 mm., respectively. Length of head to rear of fleshy operculum 334 and 340; snout 98 and 100; lengthwise axis of bony orbit 71 and 77; greatest depth of body 122 and 115; width across body at pelvic insertion 214 and 199; tip of snout to rear of maxillary 137 and 137; least width of bony interorbital 29 and 23; postorbital length of head 161 and 158; least depth of caudal peduncle 57 and 53; length of first dorsal spine 24 and 26 and of longest dorsal spine 164 and 160; longest ray of soft dorsal 160, and 168, of pectoral 172 and 183, of pelvic 279 and 288, of caudal 227 and 244, and of anal 103 and 94; snout to dorsal origin 333 and 337; snout to pelvic insertion 391 and 362.

Greatest depth 8.4 to 8.6; width of body across insertion of pelvics 4.7 to 4.9; length of head from snout tip to rear fleshy edge of operculum 3.0 to 3.1; all in standard length. Snout 3.2 and 3.4; eye 4.1 to 5.0; least width of bony interorbital 14 to 16; postorbital length of head 2.0; longest ray of pectoral 1.5 to 1.6; of pelvic 1.1 to 1.2; of spiny dorsal 2.2 to 2.3; all in length of head. Least width of bony interorbital in lengthwise axis of eye diameter 2.1 to 2.9 and in length of snout 3.4 to 3.6. Snout in postorbital length of head 1.6 to 1.8.

Teeth villiform, in bands in jaws, and in a patch on each side of vomer and palatines; tongue edentulous, its tip concave, sometimes with a small convexity near middle; lips with a row of papillae along edges; cheek bicarinate, nostrils tubular, anterior one with short dermal flap; dorsal and ventral surfaces of head naked, a few scales on preopercle, opercle and breast scaled; interorbital deeply concave; no pit behind or below eye; rear margin of opercle, subopercle, and interopercle with broad, free, dermal membrane; distally the branchiostegals have a broad dermal membrane; usually the first 2 scales of lateral line bear spines; no orbital tentacle; front edge of preorbital with 2 forwardly directed short spines; other spines and ridges

illustrated in figure 145 of this species; first dorsal spine scarcely connected with second, and contained 4⅓ to 5¼ times in second.

Color in alcohol.—Background pale or whitish, somewhat mottled or blotched with light brown and sometimes with white blotches; fins barred or marked with brown specks; ventrally plain whitish; the usual 4 or 5 brownish cross bars on dorsal surface may be present or absent.

Color when alive.—Background color whitish; dark markings reddish brown.

Remarks.—This new species differs from all other species referred to the genus *Thysanophrys* in having a row of short papillae along edges of lips.

Named *papillolabium* in reference to the papillae on the lips.

THYSANOPHRYS CHILTONAE, new species

FIGURES 146, 147

Holotype.—USNM 141009, Rongelap Atoll, Rongelap Island, near north end, lagoon coral head, depth 18 feet, July 25, S–46–286, Brock, Herald, and Kohler, standard length 142 mm.

Paratypes.—USNM 141017, Bikini Atoll, Enyu Island, lagoon channel reef, Mar. 6, S–46–8, Schultz, Brock, and Marr, 2 specimens, 30 to 77 mm.; USNM 141018, Bikini Atoll, Erik Island, ocean reef, Mar. 19, S–46–9, Schultz and Brock, 1 specimen, 91 mm.; USNM 141021, Bikini Atoll, Romuk Island, ocean reef, Apr. 1, S–46–47, Schultz, 1 specimen, 79 mm.; USNM 141019, Bikini Atoll, Urochi Island, ocean reef, July 13, S–46–251, Herald, 1 specimen, 100 mm.; USNM 141020, Bikini Atoll, Bikini Island, ocean reef, July 16, S–46–253, Herald, 1 specimen, 102 mm.; USNM 141015, Bikini Atoll, one-fourth mile off Amen Island, lagoon, depth 30 feet, Aug. 4, S–46–307, Herald and Brock, 3 specimens, 26 to 66 mm.; USNM 141016, Bikini Atoll, Arji Island, lagoon, depth 20 to 40 feet, Aug. 7, S–46–308, Brock and Herald, 2 specimens, 53 to 57 mm.; USNM 141014, Bikini Atoll, Reere Island, lagoon reef, Aug. 12, S–46–332, Herald and Brock, 2 specimens, 65 to 85 mm.; USNM 141024, Bikini Atoll, lagoon reef, halfway between Bikini and Amen Islands, July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 1 specimen, 86 mm.; USNM 141013, Rongelap Atoll, channel between Eniaetok and Erapuotsu Island, July 20, S–46–267, Herald and Brock, 2 specimens, 53 and 110 mm.; USNM 141010, Rongelap Atoll, Rongelap Island, lagoon coral head, depth 18 feet, July 25, S–46–286, Brock, Herald, and Kohler, 11 specimens, 36 to 143 mm. taken with the holotype; USNM 112394, Rongelap Atoll, Naen Island, July 30, S–46–302, 1 specimen, 91 mm.; USNM 141011, Rongelap Atoll,

Yugui Island, ocean reef, July 31, S–46–304, Herald, 1 specimen, 59 mm.; USNM 141012, Rongelap Atoll, Lomuilal Island, Aug. 1, S–46–306, Herald, 1 specimen, 48 mm.; USNM 141022, Eniwetok Atoll, Rigili Island, lagoon, May 30, S–46–189, Schultz, 1 specimen, 129 mm.; USNM 141023, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 6 specimens, 111 to 129 mm.; USNM 99652, Philippine Islands, 7 miles off Nagubat Island, 9°43′ N., 125°48′15″ E., 44 fathoms, *Albatross*, May 9, 1908, 1 specimen, 158 mm.

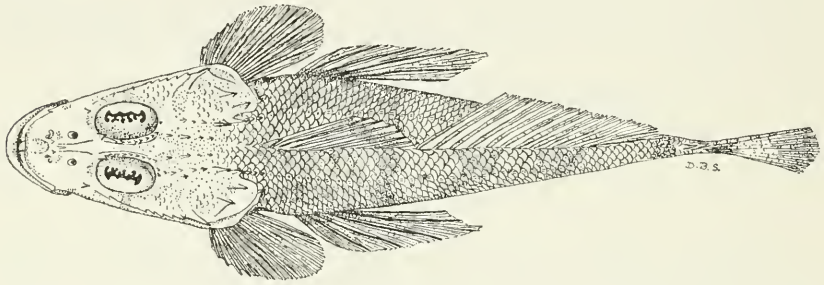

FIGURE 146.—*Thysanophrys chiltonae*, new species, holotype, USNM 141009, from Rongelap Atoll. Drawn by Dorothea B. Schultz.

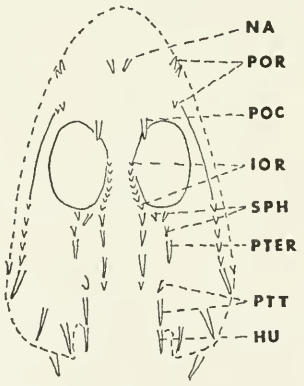

FIGURE 147.—A sketch of the cranial spines of *Thysanophrys chiltonae*, new species, paratype, USNM 141023, HU, humeral; IOR, interorbital ridge; NA, nasal; POC, preocular; POR, preorbital; PTER, pterotic; PTT, posttemporal; SPH, sphenotic. See figure 145 for names of other spines.

Description.—The following counts are recorded for the holotype: Dorsal I,VIII–12; anal 11; pectoral ii,14,v–i,14,v; pelvic I,5–I,5; oblique rows of scales above lateral line corresponding to number of pores on lateral line 53; vertical rows of scales below lateral line 80; developed gill rakers on first arch 1+1+4; branched caudal fin rays 4+5; scales from spiny dorsal origin to lateral line 5½ or 6 and soft

dorsal 6; anal origin to lateral line 17. Additional counts are recorded in table 126.

The following measurements, expressed in thousandths of the standard length, are recorded, first for the holotype, then for a paratype. Standard lengths 142 and 59 mm., respectively. Length of head to rear of fleshy operculum 352 and 400; snout 120 and 136; lengthwise axis of bony orbit 85 and 93; greatest depth of body 74 and 102; width across body at pelvic insertion 195 and 170; tip of snout to rear of maxillary 134 and 144; least width of bony interorbital 20 and 17; postorbital length of head 161 and 163; least depth of caudal peduncle 45 and 44; length of first dorsal spine 25 and 20, and of longest dorsal spine 155 and 166; of longest ray of soft dorsal 144 and 157, of pectoral 163 and 187, of pelvic 290 and 280, of caudal 211 and 238, and of anal 113 and 111; snout to dorsal origin 373 and 397, and to pelvic insertion 387 and 428.

Greatest depth 7.5 to 8.5; width of body across insertion of pelvics 4.8 to 5.8; length of head from tip of snout to rear fleshy edge of operculum 2.8 to 2.9; all in standard length. Snout 2.9 to 3.0; eye 4.1 to 4.3; least width of bony interorbital 18 to 23; postorbital length of head 2.2 to 2.3; longest ray of pectoral 2.0 to 2.2, of pelvic 1.4, and of spiny dorsal 2.5 to 2.6; all in length of head. Least width of bony interorbital in long axis of eye 5.5 to 5.9, and in length of snout 6.8 to 7.8. Snout in postorbital length of head 2.8 to 2.9.

Teeth villiform, in bands on jaws and in a patch on each side of vomer and palatines; tongue edentulous, its tip concave, with a slight convexity near middle; lips without minute fringe or tiny papillae; cheek bicarinate; nostrils tubular, anterior one with a short dermal flap; dorsal and ventral surfaces of head naked; opercle and preopercle with some scales; interorbital concave; no pit behind orbit; margin of operculum with a wide dermal flap having a deep notch opposite lower preopercular spine; first three scales of lateral line bearing spines; no orbital tentacle; front edge of preorbital usually with a slightly projecting spine; other cranial spines and ridges illustrated in figure 146 of this species; first dorsal spine scarcely connected to second and contained 4½ to 5½ in it.

Color in alcohol.—Background pale or whitish with 4 or 5 obscure, slightly brownish, crossbars on back; ventral sides whitish; dorsal surface of head and body sometimes with small white blotches and body with scattered, slightly darkened, small blotches or specks; usually a brown-edged band across interorbital space and cheeks, interrupted by eyes; pectoral, both dorsals, and caudal fins with dark bars; near tip of spiny dorsal is a blackish blotch more intense than bars; pelvics barred, usually persistent darker blotches on dorsal

surface at base, near middle, and near tips of rays; first dorsal spine slightly blackish or brownish; lips barred.

Color when alive.—The darker markings are light yellowish brown; pale areas and blotches white.

Ecology.—This species occurs in loose sandy areas between coral heads.

Remarks.—It is with regret that we add a new name to the already confused literature for this family. After studying what we think are all of the descriptions for known species referrable to the genus *Thysanophrys*, as recognized and defined in the key to genera, we find no species already described that is close to this one from the northern Marshall Islands. *T. chiltonae* is characterized by its long snout, large orbits, and very narrow interorbital space in conjunction with a spine on the preorbital in front of eye in line with another on ridge of first suborbital below front of eye, then 4 or 5 more spines on suborbital ridge mostly behind eye, and a broad opercular membrane with a deep notch. We can find no other species in the genus *Thysanophrys* that has such characters in combinations with 53 or 54 pores in the lateral line. *Platycephalus cooperi* Regan is closely related but has 58 to 65 pores in lateral line; the minor ridges of the head are granulated, and the eye is about 1.1 in snout. Although *Insidiator diversidens* has 52 or 53 pores in the lateral line, the suborbital ridges are serrated throughout their length, with only about 2 or 3 stronger spines, and the first 10 to 15 scales of lateral line bear small spines, unlike *T. chiltonae.*

THYSANOPHRYS ARENICOLA, new species

PLATE 130,B,C; FIGURE 148

Holotype.—USNM 141007, Rongelap Atoll, Naen Island, lagoon reef, July 30, S–46–302, Herald, standard length 128 mm.

Paratypes.—USNM 112391 taken with holotype and bearing same data; standard length 105 mm.; USNM 112392, Rongelap Atoll, Arbor Island, ocean reef, June 16, S–46–213, Schultz, 1 specimen, 56 mm.; USNM 141733, Rongelap Atoll, Mellu Island, lagoon reef, June 19, S–46–220, Schultz and Herald, 1 specimen, 25 mm.; USNM 112393 Rongerik Atoll, Bock Island, June 27, S–46–237, Schultz and Herald, 1 specimen, 72 mm.; Rongerik Atoll, Latoback Island, Aug. 16, 1947, Univ. Washington, standard length 173 mm.; Bikini Atoll, Bikini Island, June 28, 1946, Univ. Washington, 4 specimens, 121 to 176 mm.; USNM 152919, Bikini Atoll, Bikini–Amen reef, Aug. 2, 1946, Univ. Washington, 1 specimen, 75 mm.; USNM 152918, Eniwetok Atoll, Biijiri Island, July 26, 1948, Univ. Washington, 1 specimen, 75 mm.

Description.—The following counts are recorded first for the holo-

type, then for the paratypes, respectively: Dorsal rays always IX–12; anal 12, 12, 13, 12, 12, 12, 12, 12; pectoral ii,14,v–ii,15,iv, i,15,v–i,15,v, i,16,iv–i,16,iv, i,15,v–i,15,v, i,15,v–i,15,v, i,15,v–i,15,v, i,15,v–i,15,v, i,14,vi–i,14,vi; branched caudal rays 5+4 or 5+5; gill rakers developed on first gill arch 1+1+4, 1+1+5, 1+1+4, 1+1+5, 1+1+4, 1+1+4, 1+1+4, 1+1+4; pores in lateral line 52, 52, 52, 53, 52, 53, 52, 53; vertical scale rows below lateral line 76, 79, 82, 81, 80, 80, 81, 84; vertical scale rows from upper edge of gill opening to base of caudal fin 58, 59, 59, 61, 60, 62, 61, 64, and 58; scales in a postero-oblique row from spiny dorsal fin to lateral line 7, 8, 8, 7, 8. 8, 8, 9; and from anal origin to lateral line 15, 16, 16, 16, 16, 17, 17, 17,

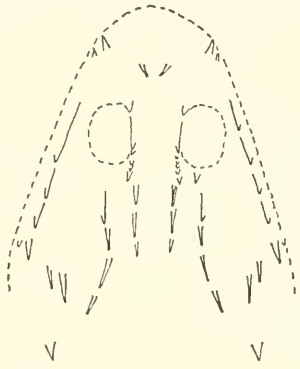

FIGURE 148.—A sketch of the cranial spines of *Thysanophrys arenicola*, new species, holotype, USNM 141007, from Rongelap Atoll

The following measurements, expressed in thousandths of the standard length, are recorded, first for the holotype, then for three paratypes. Standard lengths 128, 173, 176, and 75 mm. Length of head to rear of fleshy operculum 324, 324, 330, and 340; snout 104, 104, 102, and 109; lengthwise axis of bony orbit 62, 61, 54, and 71; greatest depth of body 117, 124, 122, and 123; width across body at pelvic insertion 219, 231, 239, and 200; tip of snout to rear of maxillary 145, 139, 139, and 143; least width of bony interorbital 41, 39, 40, and 33; postorbital length of head 152, 156, 165, and 153; least depth of caudal peduncle 55, 54, 53, and 51; length of first dorsal spine 23, 24, 26, and 30, and of longest dorsal spine 166, 156, 153, and 167; longest ray of soft dorsal 156, 153, 147, and 163; of pectoral 172, 156, 179, and 192; of pelvic 262, 284, 274, and 296; of caudal 191, 208, 205, and 260; and of anal 90, 98, 114, and 109; snout to dorsal origin 341, 347, 341, and 353, and to pelvic insertion 371, 381, 386, and 386.

Greatest depth 7.2 to 7.8; width of body across insertion of pelvics 4.1 to 4.8; length of head from tip of snout to rear fleshy edge of operculum 3.0 to 3.1; all in standard length. Snout 3.1; eye 4.2 to

5.6; least width of bony interorbital 8.6 to 9.3; postorbital length of head 2.0 to 2.1; longest ray of pectoral 1.7 to 1.8, of pelvic 1.2 to 1.3, and of spiny dorsal 2.1; all in length of head. Least width of bony interorbital in lengthwise axis of eye diameter, 1.4 to 2.0, and in length of snout 2.5 to 2.8. Snout 1.5 to 1.6 in postorbital length of head.

Teeth villiform, in bands on jaws and palatines, and in a patch on each side of vomer; tongue edentulous, its tip concave anteriorly; lips without papillae or fringe; cheek bicarinate; nostrils tubular, anterior one with a short dermal cirrus; dorsal and ventral surfaces of head naked, but some scales behind eye on preopercle and on opercle; interorbital concave, no pit behind orbit; opercular membrane without deep notch; first 2 scales of lateral line bearing spines; no orbital tentacle; front edge of preorbital with two forwardly directed spines; cranial spines illustrated in figure 148; first dorsal spine connected by membrane to base of second spine and contained 4 to 5 times in second.

Color in alcohol.—Background coloration pale or whitish, with 5 obscure slightly dusky crossbars on back; undersides white; dorsal surfaces with scattered dusky flecks or specks; a brownish or dusky band across orbits and cheeks, with its edges usually outlined by a darker brown line; pectorals, pelvics, caudal, and dorsal fins lightly barred with darkish pigment specks; lips barred.

Order PLEURONECTIDA (=Heterosomata)

Suborder PSETTODINA

KEY TO THE FAMILIES OF PLEURONECTIDA FROM THE NORTHERN MARSHALL ISLANDS AND ADJACENT REGIONS

1*a*. Eyes on left side ..... **Bothidae** (p. 62)
1*b*. Eyes on right side.
2*a*. Preopercular margin free ..... **Pleuronectidae** (p. 66)
2*b*. Preopercular margin not free ..... **Soleidae** (p. 68)

Family BOTHIDAE

By LOREN P. WOODS

KEY TO THE GENERA AND SPECIES OF BOTHIDAE FROM THE NORTHERN MARSHALL ISLANDS AND ADJACENT REGIONS

1*a*. Scales in lengthwise series 76 to 97; interorbital width always greater than diameter of eye; greatest depth of body 1.6 to 2.0 in standard length ..... Genus **Bothus**
2*a*. Dorsal fin rays 95 to 103; anal rays 75 to 81.
Bothus mancus (Broussonet)
2*b*. Dorsal fin rays 86 to 94; anal rays 65 to 72.
Bothus pantherinus (Rüppell)
1*b*. Scales in lengthwise series 45 to 50; interorbital width always less than diameter of the eye; greatest depth of body 2.2 to 2.4 in standard length; dorsal fin rays 80; anal 63.
Arnoglossus intermedius (Bleeker)

Genus BOTHUS Rafinesque

Bothus Rafinesque, Caratteri di alcuni nuovi generi e nuove specie di animali e piante della Sicilia . . ., p. 23, 1810 (type species, *Bothus rumolo* Rafinesque).

BOTHUS MANCUS (Broussonet)

Plate 130, D

Pleuronectes mancus Broussonet, Ichthyologia . . . [no pagination], 1782 (type locality, Ulictea, Anamoka Island, Tahiti).

SPECIMENS STUDIED

Bikini Atoll: 21 stations, 80 specimens, 36 to 286 mm. in standard length.
Eniwetok Atoll: 4 stations, 4 specimens, 90 to 199 mm.
Rongelap Atoll: 3 stations, 4 specimens, 142 to 220 mm.
Rongerik Atoll: 2 stations, 9 specimens, 42 to 150 mm.
Kwajalein Atoll: 1 station, 1 specimen, 137 mm.
Guam: 2 lots, 7 specimens, 69 to 163 mm.

Description.—Dorsal fin rays 95 to 103 (mode near 100); anal 75 to 81 (mode 77 or 78); pectoral 11 or 12 (usually 12); pelvics 6; branched caudal 7 upper, 6 lower; scales in lengthwise series about 86 to 97; gill rakers on first gill arch 0+11 or 12.

Depth of body 1.65 to 1.97; length of head 3.42 to 3.89; both in standard length. Length of snout 4.04 to 4.34; diameter of upper eye 4.32 to 4.87; least interorbital width 2.76 to 4.8; postorbital part of head (hind margin of upper eye to upper edge of gill opening) 2.04 to 4.68; length of upper jaw 2.68 to 3.2; least depth of caudal peduncle 2.53 to 3.1; length of longest dorsal rays 1.92 to 2.5; of longest anal rays 1.71 to 2.59; length of middle caudal rays 1.16 to 1.61; length of pectoral fin 0.86 to 1.92; all in length of head. Angle of upper profile with lengthwise axis of body 49 degrees in large specimens to 66 in small, upper profile convex in small specimens (under 50 mm.), notched in large.

Teeth of jaws strong, pointed, close-set, slanted and curved inwards; no teeth on vomer or palatines; a knob on tip of snout, on raised bony margin of lower eye in old specimens, and on symphysis of lower jaw; interorbital area concave; anterior margin of upper eye just behind middle of lower eye in large specimens; pectoral rays all simple, upper ones becoming long and filamentous in adult males; caudal fin pointed, its middle rays longest; left pelvic fin inserted on anterior edge of isthmus, right pelvic fin inserted beside fourth ray of left fin.

Color in alcohol.—Upper surface (left side) light grayish with numerous white dots or spots varying in size from smaller than pupil to larger than eye; the larger spots made up of 2, 3, or 4 oval spots joined together; a few indistinct dark brown blotches along bases of dorsal and anal fins; 3 distinct large black blotches on middle of sides evenly spaced, the first at posterior end of lateral line arch, the second just back of middle of body, and the third about midway between

second and tip of caudal rays; scattered over entire head, body, and vertical fins are numerous minute brown or black dots of varying sizes but few as large as smallest white dots; white spotting of body continued onto bases of vertical fins; pectorals with black dots on rays, forming more or less transverse bars; under surface (right side) pale yellowish white, not pigmented, except that some specimens have scattered small brown dots on jaws, chin, and anterior part of cheek.

Color when alive.—Pale spots light cream color, sometimes tinted light blue; dark blotches purplish black; general lighter areas light grayish yellow, with numerous light orange-yellow blotches scattered about in an irregular manner.

Ecology.—This species is common on the flat, pavementlike sections of the reef and in big surge channels with sandy bottoms.

TABLE 127.—*Fin ray counts for two species of* Bothus

Species	Dorsal rays																	
	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
mancus	----	----	----	----	----	----	----	----	----	1	4	5	12	22	32	15	7	1
pantherinus	1	2	4	4	5	5	3	2	1	----	----	----	----	----	----	----	----	----

Species	Anal rays																
	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
mancus	----	----	----	----	----	----	----	----	----	----	6	13	28	27	17	8	2
pantherinus	2	2	3	8	5	4	2	1	----	----	----	----	----	----	----	----	----

BOTHUS PANTHERINUS (Rüppell)

Rhombus pantherinus RÜPPELL, Atlas zu der Reise im nördlichen Afrika . . ., Fische des rothen Meers, p. 121, pl. 3, fig. 1, 1828 (type locality, Red Sea).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 44 to 71 mm. standard length.
Eniwetok Atoll: 1 station, 1 specimen, 82 mm.
Rongelap Atoll: 2 stations, 2 specimens, 36 to 64mm.
Rongerik Atoll: 1 station, 3 specimens, 33 to 43 mm.
Guam: 7 lots, 46 specimens, 27 to 89 mm.

Description.—Dorsal fin rays 86 to 94; anal rays 65 to 72; pectoral rays 10 or 11; pelvic rays 6; branched caudal rays 7 in upper half, 6 in lower; scales in lengthwise series about 76 to 82; gill rakers lower half of first gill arch 6 to 9.

Depth of body 1.75 to 1.87; length of head 3.31 to 3.41; both in standard length. Length of snout 3.74 to 4.17; diameter of upper eye 3.9 to 4.63; least interorbital width 3.9 to 6.18; postorbital part of head 1.81 to 3.3; length of upper jaw 2.95 to 4.58; least depth of

caudal peduncle 2.77 to 2.99; length of longest dorsal rays 1.95 to 3.34; longest anal rays 1.95 to 2.65; length of middle caudal rays 1.32 to 1.5; length of pectoral fin 1.48 to 2.22; all in length of head. Angle of upper profile with lengthwise axis of body 60 to 73 degrees; upper profile convex in specimens of all sizes.

Teeth of jaws strong, pointed, close set, slanted or curved inward, slightly longer near symphysis; no teeth on vomer or palatines; premaxilla curved; maxilla with a knob on eyed side fitting into notch just in front of ventral eye; no knob on largest specimens (89 mm.) on tip of lower jaw, but a slight prominence just behind tip of snout; interorbital area concave, scaled; anterior margin of upper eye about middle of lower eye in large specimens; pectoral fin pointed, upper rays not elongate and filamentous in any of the specimens at hand; caudal rounded, middle rays longest; left pelvic fin inserted on anterior edge of isthmus, right pelvic fin inserted beside fourth ray of left fin.

Color in alcohol.—Pale, dirty yellowish to brownish; blind side without pigment, eyed side with numerous small white-edged circles or oval spots, none as large as eye, scattered all over head and body, traces of dusky black spots of about the same size scattered between white spots and circles; in darkest specimens, small spots are pale areas with black spots more prominent; all specimens with a single round black spot about as large as eye on lateral line about midway between tip of caudal rays and upper eye; darkest specimen with minute flecks of black scattered all over head, body, and vertical fins; pectorals and pelvics colorless in most specimens, pectorals with three transverse rows of small dots in some.

Genus ARNOGLOSSUS Bleeker

Arnoglossus Bleeker, Versl. Akad. Wet. Amsterdam, vol. 13, p. 427, 1862 (type species, *Pleuronectes arnoglossus* Schneider).

ARNOGLOSSUS INTERMEDIUS (Bleeker)

Plate 124,C

Platophrys intermedius Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 47, 1866 (type locality, Menado, Celebes).

SPECIMEN STUDIED

Bikini Atoll: Arji Island, 100 yards off shore, lagoon coral area at depths up to 40 feet, poison and spear, Aug. 7, 1946, S–46–308, Brock and Herald, 1 specimen, 24.4 mm.

Description.—Dorsal fin rays 80; anal 63; pectoral 11; pelvics 6–6; caudal rays 9+8 counting all rays; scales not yet formed; gill rakers on first gill arch 0 on upper arch, 8 on lower.

Depth of body 2.35; length of head 3.26; both in standard length (tip of snout to base of middle caudal rays). Snout 3.75; eye 3.75;

postorbital part of head (hind margin of lower eye to posterior edge of opercular membrane) 2.08; length of upper jaw 2.34; least depth of caudal peduncle 2.5; length of first dorsal ray 1.03; length of caudal (approximate, broken) 1.5; length of pectoral fin 1.66; all in length of head. Angle of upper profile with lengthwise axis of body about 42 degrees.

Teeth developed in both jaws, fine, slightly curved; vomer (?) with its head elongated, extending down into mouth, its tip rounded and slightly compressed; premaxillary somewhat protractile; a small knob on tip of snout, a depression between eyes and this knob; eyes close together, separated only by a very narrow raised bony ridge, the anterior half with a shallow median groove; first dorsal ray elongated nearly as long as head, its distal fifth expanded, next few dorsal rays free for almost their entire length but not elongated; lateral line straight, with only slight curve above pectoral, not arched; gill rakers short, somewhat expanded, their edges serrate; upper (left) pelvic fin base longer than right, latter with its first ray inserted at a point even with fourth ray of former; scales on head and body not evident, apparently not yet developed.

Color in alcohol.—Pale yellowish head and body, minute dusky pigment flecks scattered around pectoral base and similar spots concentrated into faint irregular round spots along dorsal and ventral edges of body; distal tip of elongated dorsal first ray dusky, rest of dorsal fin colorless except for a dusky ray every 8 or 10 rays; caudal mostly colorless, with scattered pigment areas not forming a definite pattern; anal colorless, with a single dusky ray every few rays.

Remarks.—Although this species is represented in the "Crossroads" collection by only a single postlarval specimen on which the scales have not yet formed, we feel reasonably certain that we have made a correct identification since it has the elongate first dorsal ray with its tip expanded, and possesses the short palmate gill rakers that are broad and with their margins spinulate as described by Norman (Flatfishes, p. 198, 1934).

Family PLEURONECTIDAE

By Loren P. Woods

Genus SAMARISCUS Gilbert

Samariscus Gilbert, Bull. U.S. Fish. Comm., vol. 23, pt. 2, p. 682, 1905 (type species, *Samariscus corallinus* Gilbert, holotype USNM 51596).

SAMARISCUS TRIOCELLATUS, new species

Figure 149

Holotype.—USNM 141767, Bikini Atoll, lagoon, eastern end, coral heads at depths of 20 to 25 feet, diving, spearing, March 26, S–46–42, Brock and Schultz, 1 specimen, 52.7 mm. in standard length.

Paratypes.—USNM 141768, Rongelap Atoll, Rongelap Island, near north end, lagoon coral head at depth of 18 feet, July 25, S–46–286, Brock, Herald, and Kohler, 3 specimens, 41.5 to 56.3 mm.; USNM 167246, Onotoa Atoll, Gilbert Islands, lagoon, July 19, 1951, Randall, 1 specimen, 32 mm.; USNM 164421, Oahu, Hanauma Bay, Mar. 22, 1949, Gosline, 1 specimen, 65 mm.

Description.—Counts and measurements of holotype are given first, followed by range of variation in paratypes in parenthesis. Measurements are expressed in thousandths of the standard length. Dorsal fin rays 64 (66 to 70); anal 52 (51 to 47); pectoral 5, one rudimentary ray on blind side; pelvics 4 on eyed side, fifth rudimentary (5 in paratypes), 5 on blind side; branched caudal 6 (6)+5 (5 to 7); scales in lateral line 71 (73 to 75); gill rakers on first gill arch 7 (6 to 8), all rudimentary.

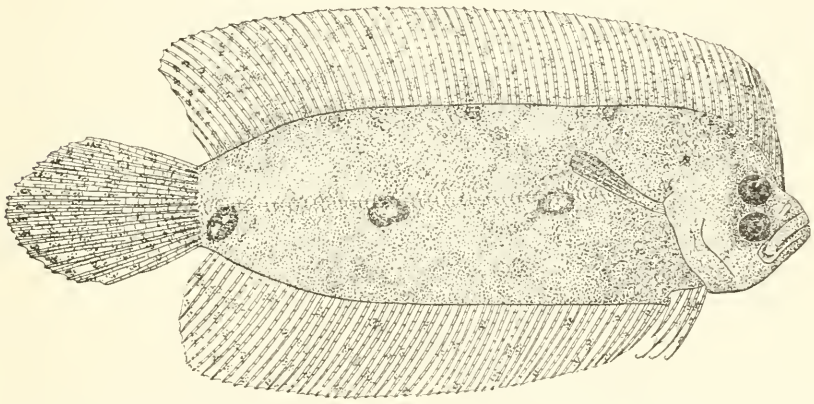

FIGURE 149.—*Samariscus triocellatus*, new species, holotype, USNM 141767, from Bikini Atoll. Drawn by A. M. Awl.

The specimen from Oahu has dorsal 70, anal 56, pectoral 5, caudal 6+7; scales 75. Depth of body 323 (355 to 400); length of head 243 (234 to 277); snout (anterior margin of upper eye to tip of premaxillary) 80 (76 to 84); diameter of upper eye 53 (53 to 67); interorbital 14 (12 to 14); postorbital part of head (posterior margin of upper eye to upper edge of gill opening) 95 (98 to 120); length of upper jaw 106 (92 to 118); depth of caudal peduncle 142 (130 to 147); length of longest dorsal rays 179 (169 to 193); length of longest anal rays 196 (178 to 189); length of middle caudal rays 292 (261 to 284); length of pectoral rays 204 (191 to 217); angle of dorsal profile 42 (42 to 45) degrees with lengthwise axis of body.

Teeth of jaws fine, sharp, pointed, close set in 3 or 4 rows forming narrow band, those next to symphysis somewhat enlarged; vomer and palatines not toothed, vomer(?) head elongated, forming a curving

spur extending down into mouth cavity, its tip rounded, broadening basally. Eyes close together, separated by a raised bony ridge, interorbital area scaled; preopercular margin free; lateral line nearly straight; pectoral shorter than head; no pectoral evident on blind side; dorsal fin origin on blind side slightly anterior to upper eye; first dorsal rays slightly longer than succeeding ones and free for a considerable part of their length.

Color in alcohol.—Dark reddish brown (paratypes light yellowish brown); head and body mottled with small round pale spots and large oval spots; 3 round or oval dark-brown-edged rings, about size of eye, with small pale centers located on or immediately below lateral line, the first under tip of pectoral, the third on caudal peduncle, and the second midway between. Pectoral fin with its rays completely black in type, base pale and tips black in paratypes.

Dorsal and anal fins with scattered minute black dots; caudal fin dusky, mottled on basal two-thirds, small dots arranged in irregular transverse rows on distal third.

Remarks.—Samariscus triocellatus most closely resembles *S. huysmani* Weber from the Java Sea and *S. corallinus* Gilbert from Hawaii. *S. triocellatus* has fewer dorsal and anal fin rays than *S. corallinus* and differs from this and all other known species of the genus *Samariscus* in being marked with 3 distinct ocelli in a line along the middle of sides.

Named *triocellatus* because of the three-eyed pattern mentioned above.

Suborder SOLEINA

Family SOLEIDAE

By Loren P. Woods

I (Schultz) note in studying the fishes of this family that the types of *Symphurus fasciolaris* Gilbert (Proc. U.S. Nat. Mus., vol. 14, p. 566, 1892, Gulf of California) generally have been overlooked by ichthyologists. Therefore, I call attention to the presence in the U.S. National Museum of USNM 44406, which I select as the lectotype.

KEY TO GENERA AND SPECIES OF SOLEIDAE FROM THE NORTHERN MARSHALL ISLANDS AND ADJACENT REGIONS

1*a*. Pectoral fins present; nasal tentacle longer than eye; transverse wavy dark lines on head and body; dorsal fin rays 92 to 98; anal rays 80 to 84. **Aesopia heterorhinos** (Bleeker)

1*b*. Pectoral fins absent; nasal tentacle shorter than eye; body pale yellowish to brownish with small indistinct brown spots; pelvic fins free from anal fin and from anal papilla; lateral line on blind side with dorsal branch beginning on snout and following dorsal outline along bases of dorsal

rays for at least the length of head; eyes close together, upper placed slightly anterior to lower; no pores at base of dorsal and anal fin rays on eyed side; many dorsal and anal fin rays branched; dorsal rays 67 to 77; anal rays 44 to 77 ..... Genus **Aseraggodes** Kaup

2*a*. Snout not overlapping tip of lower jaw; pelvic fins symmetrical or nearly so.

3*a*. Pelvic fin rays short, 3.3 to 3.9 in head, tip of longest reaching just past first anal ray; pelvic fin base long; last dorsal and anal rays with low membrane connected with base of outer caudal ray; dorsal rays 74; anal 57; scales about 67 from above gill opening to base of caudal rays ..... **Aseraggodes melanostictus** (Peters)

3*b*. Pelvic fin rays long, 1.8 in head, tip of longest reaching to fourth anal ray, narrow, bases short; dorsal, anal, and caudal not joined by membrane; dorsal rays 72; anal 51; scales about 72 from above gill opening to base of caudal rays.

Aseraggodes whitakeri, new species

2*b*. Snout overlapping lower jaw; pelvic fin asymmetrical, the right with longer base than left; rays short, 2.64 in head; dorsal fin rays 67; anal 44; scales in lateral line about 65 from above gill opening to base of caudal rays ..... **Aseraggodes smithi**, new species

Genus AESOPIA Kaup

Aesopia Kaup, Arch. Naturg., vol. 24, p. 97, 1858 (type species, *Aesopia multifasciata* Kaup.—Chabanaud (Bull. Inst. Oceanogr. Monaco No. 555, p. 17, 1930) and not *Aesopia cornuta* Kaup as restricted by Günther (Cat. of the Fishes in the British Museum, vol. 4, p. 487, 1862).

AESOPIA HETERORHINOS (Bleeker)

PLATE 132,A

Solea heterorhinos BLEEKER, Act. Soc. Sci. Indo.-Néerl., vol. 1, p. 64, 1856 (type locality, Amboina).

SPECIMENS STUDIED

Rongelap Atoll: Naen Island, west side, lagoon reef, July 30, S–46–302, Herald, 2 specimens, 21 to 41 mm.

Rongelap Atoll: Yugui Island, west side, ocean reef next to small boat passage, July 31, S–46–304, Herald, 3 specimens, 41 to 48 mm.

Description.—Dorsal fin rays 92 to 98 (94 or 95); anal 80 to 84; pectorals 8 (upper two longest, rest rudimentary); pelvics 4; caudal, counting all rudiments, 18; scales in lateral line 117 to 122; gill rakers all rudimentary, not counted.

Depth of body 3.03 to 3.43; length of head 4.84 to 5.0; both in standard length. Length of snout 3.65 to 4.58; eye 3.90 to 4.32; interorbital 0; postorbital 1.76 to 1.95; length of upper jaw 2.79 to 3.11; depth of caudal peduncle 3.27 to 3.89; length of longest dorsal rays 2.17 to 2.21; length of longest anal rays 2.29 to 2.37, length of middle caudal rays 1.3 to 1.35; length of longest pectoral ray 2.1 to 2.71; all in length of head. Angle of dorsal profile with lengthwise axis of body about 33 degrees.

No teeth in jaws, gums plicate; nasal tentacle slightly longer than diameter of eye; dorsal fin originating above anterior margin of upper

eye; head completely scaled except for opercular membrane, which is joined to upper pectoral rays on both eyed and blind side; pectoral fin on blind side rudimentary; pelvics equal and inserted on same level just behind gill membranes; gill membranes attached to isthmus but forming a broad fold; lateral line straight, extending onto basal third or half of caudal fin. Dorsal and anal fins low, even, tips of rays free, last rays slightly longer than the rest; caudal fin rounded, its middle rays longest.

Color in alcohol.—Ground color of head and body light brown; head with about 5 or 6 narrow transverse single reddish or reddish brown lines; body with about 15 or 16 pairs of transverse reddish lines, part of these wavy, part straight, part broken, extending onto bases of dorsal and anal fins; dorsal and anal fins with narrow white margin, yellow in life, then a submarginal black band with narrow V-shaped markings proximal, these markings alternate long and short for most part, the long ones frequently joining the paired transverse lines and the short ones spaced between; tip of caudal with narrow pale margin, then a broad submarginal black band rest of caudal pale except for a narrow wavy transverse line on basal third (this line near base missing on smallest specimen and faint on one large specimen that has basal two thirds of caudal dusky).

Genus ASERAGGODES Kaup

Aseraggodes Kaup, Arch. Naturg., vol. 24, p. 103, 1858 (type species, *Aseraggodes guttulatus*).

ASERAGGODES MELANOSTICTUS (Peters)

Plate 132,B

Solea (*Achirus*) *melanosticta* Peters, Monatsb. Akad. Wiss. Berlin, p. 845, 1876 (1879) (type locality, Bougainville Island, 40 fathoms).

SPECIMEN STUDIED

Kwajalein Atoll: Ennylabegan Island, near southern end, lagoon reef, September 1, S–46–397, Herald, 1 specimen, 39 mm.

Description.—Dorsal fin rays 74; anal 57; pectorals absent; pelvics 5; branched caudal 7 upper, 8 lower; scales in lateral line 67 from head to base of middle caudal rays; gill rakers on first arch 2, rudimentary.

Depth of body 2.29; length of head 3.82; both in standard length (tip of snout to base of middle caudal rays). Snout (anterior margin of upper eye to tip of snout) 4.64; eye 5.68; interorbital 20.4; postorbital part of head (hind margin of lower eye to posterior margin of opercular membrane) 1.93; length of upper jaw 3.2; depth of caudal peduncle 2.04; length of longest dorsal ray 2.0; length of longest anal ray 2.13; length of middle caudal rays 1.2; all in length of head. Angle of dorsal profile with lengthwise axis of body about 40 degrees.

Scales ctenoid on both sides; head on blind side with numerous close set papillae; caudal fin almost free from dorsal and anal fins, these connected to caudal by membrane at bases; most of dorsal and anal rays branched at tips; snout rounded, not overlapping lower jaw; premaxillary curved; eyes close together, upper eye slightly in advance of lower, interorbital space concave, scaled; length of nasal tentacle about half diameter of eye; lateral line of eyed side straight, simple, on blind side, lateral line extending forward to tip of snout, though interrupted, a branch going off from its anterior end dorsally and following outline of dorsal, interrupted several times and finally disappearing about 37th dorsal ray; pelvic fins symmetrical, free from anal, their bases short, oblique, not set in midline; caudal fin, rather pointed, lanceolate.

Color in alcohol.—Generally light brownish, head and body mottled with patches of dark brown arranged more or less along dorsal and ventral edges and middle of sides, fainter irregular brown patches between these, everywhere minute round or oval light spots; vertical fins with dusky brown edges, more or less pale mesially and with a brown line along anterior margin of ray every few rays; blind side pale yellowish brown.

Remarks.—Although this specimen agrees very well with the description given for *A. melanostictus* (Peters), it is identified with uncertainty because of the additional lateral line which was not mentioned by Peters and because of the symmetrical, free pelvic fins.

ASERAGGODES WHITAKERI, new species

FIGURE 150

Holotype.—USNM 141765, Rongelap Atoll, Kieshiechi Island, north end, lagoon coral head at depths of 20 feet, poison and spear, July 24, 1946, S–46–285, Brock and Herald, 38 mm.

Description.—Dorsal rays 72; anal 51; pectorals absent; pelvics 6 on right, 5 on left; caudal ii,7–7,ii; scales in lateral line (counting from above gill opening to base of caudal rays) 72; gill rakers rudimentary.

Measurements expressed in thousandths of standard length are given in table 128. Depth of body 2.45; length of head 4.2; both in standard length. Snout 4.28; lower eye 4.09; interorbital not measured; eyes in contact above very narrow concave scaled area; postorbital part of head 1.92; length of upper jaw 4.5; depth of caudal peduncle 2.0; length of longest dorsal ray 1.63; length of longest anal ray 1.67; length of middle caudal rays 0.82; length of longest pelvic ray 1.8; all in length of head (tip of snout to posterior margin of opercular membrane).

Dorsal fin originating directly in front of anterior margin of upper eye; upper jaw curved but snout not hooked over lower jaw; upper

jaw with posterior end reaching just below anterior margin of lower eye; nasal tentacle a little more than half the diameter of eye; scales all ctenoid, a fringe of slender fleshly papillae from chin along lower edge of opercular bones; blind side of head largely lacking these papillae except in region close around mouth; lateral line on blind side with dorsal branch following upper outline of head along base

TABLE 128.—*Measurements of* Aseraggodes smithi, A. whitakeri, *and* A. melanostictus *expressed in thousandths of the standard length*

Characters	*smithi*	*whitakeri*	*melanostictus*
Standard length in mm.	18.5	38	39
Depth of body	390	395	435
Length of head	243	237	262
Length of snout	81	55	57
Diameter of eye	65	58	46
Postorbital length	130	124	----
Upper jaw	87	53	85
Depth of caudal peduncle	119	118	128
Length of longest dorsal ray	157	145	131
Length of longest anal ray	124	142	123
Length of middle caudal ray	260	290	205
Length of pelvic ray	92	132	101

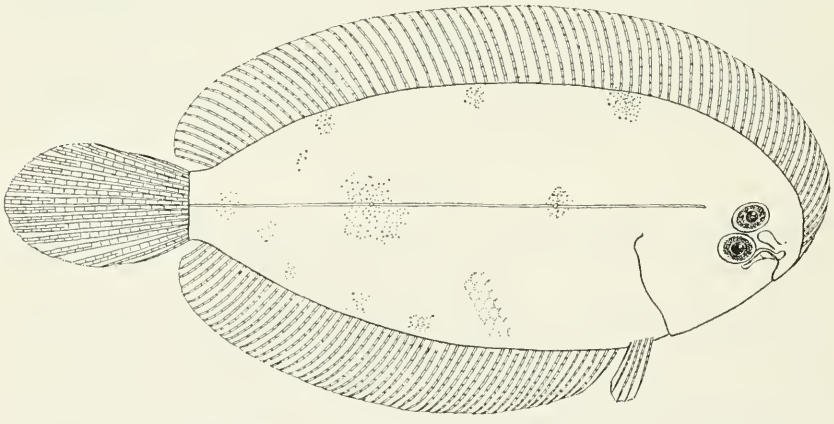

FIGURE 150.—*Aseraggodes whitakeri*, new species, holotype, USNM 141765, from Rongelap Atoll. Drawn by A. M. Awl.

of dorsal fin around to base of 32nd dorsal ray; pelvic fins long, reaching to fourth anal ray, narrow, their bases narrow, the base of right slightly longer than left. Left slightly displaced, both pelvic fins free; anal papilla in midline between base of pelvic and insertion of first anal ray, closer to latter; dorsal and anal rays nearly all branched near tips.

Color in alcohol.—Light yellowish brown with 3 indistinct, small, reddish brown spots along dorsal margin of back, 3 along lateral line,

and 3 along ventral margin; opercle with some dusky coloring, numerous minute spots of dusky color scattered over head and body.

Remarks.—*A. whitakeri* appears to be quite closely related to *A. kobensis* Steindachner and to *A. smithi* Woods. It differs, however, from the former in having a larger number of scales in the lateral line and in the longer pelvic fin rays; it differs from *A. smithi* in the lack of an overhanging snout, in the shape of the pelvic fins, and in having a larger number of dorsal and anal fin rays. *A. whitakeri* differs from other species of *Aseraggodes*, which have the eyes close together and a similar number of scales and fin rays (i.e. *A. melanostictus* Peters and *A. normani* Chabanaud), in the shape of the pelvic fins.

Named in honor of Dr. Douglas M. Whitaker of Stanford University.

ASERAGGODES SMITHI, new species

FIGURE 151

Holotype.—USNM 141766, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 18.5 mm.

Description.—Dorsal rays 67; anal 44; pectorals absent; pelvics 5 on eyed side, 4 on blind; caudal rays iii,6–6,iii, scales in lateral line about 65, not fully imbricated; gill rakers rudimentary.

Measurements expressed in thousandths of standard length are given in table 128. Depth of body 2.57; length of head 4.12; both in standard length. Snout (anterior margin of lower eye to tip of upper jaw) 3.0; diameter of lower eye 3.74; interorbital space not measured, less than diameter of pupil, eyes close together; postorbital part of head 1.87; length of upper jaw 2.8; depth of caudal peduncle 2.04; length of longest dorsal ray 1.55; length of longest anal ray 1.95; length of middle caudal rays 0.94; length of pelvic rays 2.64 all in length of head.

Dorsal fin originating on snout directly in front of anterior margin of upper eye; snout overlapping lower jaw slightly; upper jaw somewhat curved, its posterior end reaching just below anterior margin of lower eye; nasal tentacle short, less than diameter of pupil; a narrow membrane with short papillae forming fringe along lower margin of head from chin to opercular opening; lateral line straight, on blind side with a dorsal branch running from snout, following dorsal outline and ending at base of 16th dorsal ray; under side of head with papillae only around mouth and along this dorsal branch of lateral line; interorbital space very narrow, concave, about 5 mm. separating eyes; right pelvic fin with longer base than left, both fins free; anal papilla displaced to left, free; pelvic fins very close to papilla but not joined to it by a membrane; many of dorsal and anal fin rays branched, scales all ctenoid.

Color in alcohol.—Pale yellowish, head and body with small brown spots distributed as follows: 3 along dorsal outline at bases of 14th, 26th, and 37th dorsal rays, slightly larger spots on back a little anterior and mesial to marginal spots, 2 fairly distinct spots on middle of sides; belly and lower sides with scattered dusky brown flecks of pigment; fins largely colorless.

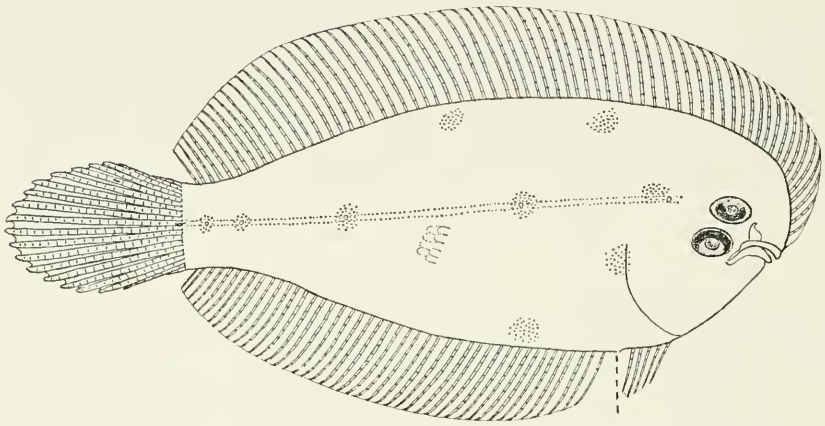

FIGURE 151.—*Aseraggodes smithi*, new species, holotype, USNM 141766, from Rongerik Atoll. Drawn by A. M. Awl.

Remarks.—*Aseraggodes smithi* is similar in general appearance to *A. melanostictus* Peters but differs in number of dorsal and anal fin rays and of scales in lateral line; *A. smithi* is related to *A. dubius* Weber but has the eyes placed much closer together; it differs from *A. whitakeri* in having an overhanging snout and short asymmetrical pelvic fins with rather long bases, and from all other known species of *Aseraggodes* in having a different combination of number of dorsal and anal fin rays and scales in lateral line (even allowing plus or minus five), or in one or more of the characters mentioned above so that it can be separated from the presumed closely related species.

Named in honor of Osgood R. Smith of the U.S. Fish and Wildlife Service.

Order ECHENEIDA

Family ECHENEIDAE: Diskfishes

By Ernest A. Lachner

This family is recognized by the laminated adhesive disk on the top of the head that enables its members to attach themselves to sharks, rays, bony fishes, turtles, ships, and various buoyant objects. It is believed that the disk represents a modified spinous dorsal fin. The transformation of this spinous dorsal fin was accompanied by a

cephalic migration, probably through use, which brought about a modification of certain cranial bones. This modification was mainly a process of a flattening and widening of the bones to form a cranial table for the disk.

The possible relationship of the echeneids to a number of comparatively diverse families has been suggested, owing to their superficial external appearances or to their habits or to their comparatively similar osteology. Among these are the Rachycentridae, Carangidae, Pomatomidae, the seriolid pilotfish *Naucrates*, and the centrolophid, *Palinurichthys*. A distant relationship with gobioid and blennioid stocks also has been suggested. Their derivation from some perciform stock is generally agreed upon. Two families are recognized, the living Echeneidae, comprising two distinct subfamilies with a total of eight species, and the monotypic fossil Opisthomyzonidae.

Although only two species are known from the Marshall and Marianas islands, four additional species and possibly a fifth, *Remora australis*, occur in Oceania. All seven are included in the key. The two species reported from the study area, *Echeneis naucrates* and *Remora remora*, have a variety of hosts, but other species of echeneids have more restricted if not specific hosts: for example, *Remora brachyptera* and *Remora osteochir* are found almost always on swordfish, sailfish, and marlin; *Remorina albescens* is almost always found on manta rays; and *Remora australis*, only on cetaceans. All diskfishes occurring in Oceania have a worldwide distribution in the warm seas. In several species, only minor infraspecific differentiation occurs between Atlantic and Indo-Pacific oceanic populations.

KEY TO THE SPECIES OF ECHENEIDAE FROM OCEANIA

1*a*. Caudal fin in the young lanceolate, the middle rays produced in a long filament; almost truncate in the adults, with longer outer rays on the lobes; pectoral fins acute in the adults; anal fin base long, anal rays 29 to 41; lower jaw produced in a flap; body slender, elongate, usually with a dark lateral horizontal stripe; pelvic fins narrowly adnate to abdomen; disk smaller; vertebrae 30 or 40. (Echeneiinae.)

2*a*. Disk laminae numerous, 18 to 27; body elongate, species attaining a large size, over 2 feet in length; vertebrae 30. (Sharksucker.) **Echeneis naucrates** Linnaeus

2*b*. Disk laminae fewer, 9 to 11; body elongate, very slender; size smaller, usually less than 18 inches in length; vertebrae 40; plate 131, B. (Slender suckerfish.) **Phtheirichthys lineatus** (Menzies)[20]

1*b*. Caudal fin in young forked, transforming to a more or less emarginate or truncate fin in adults; pectoral fins rounded; anal fin base short; anal rays 18 to 28; lower jaw not produced in a flap; body stout, short; horizontal stripe wanting; pelvic fins broadly adnate to abdomen in all species except *Remorina albescens;* disk larger; vertebrae 26 or 27. (Remorinae.)

[20] *Echeneis lineata* Menzies, Trans. Linn. Soc. London, vol. 1, p. 187, pl. 17, fig. 1, 1791 (type locality, tropical Pacific Ocean).

3*a*. Gill rakers numerous, total including all rudiments more than 27. (Remora.)
Remora remora (Linnaeus)

3*b*. Gill rakers fewer, total including all rudiments less than 21.

4*a*. Disk laminae numerous, more than 24; total gill rakers 17 to 20; plate 131,F. (Whalesucker.)----------**Remora australis**[21] (Bennett)

4*b*. Disk laminae less than 20; total gill rakers 11 to 17.

5*a*. Pelvic fins broadly adnate to abdomen; disk laminae 15 to 19; pectoral fin rays 20 to 27; vertebrae 27.

6*a*. Dorsal fin rays 27 to 34; disk smaller, its length 28 to 40 percent of standard length; disk not extending posteriorly as far as end of depressed pectoral fin; distal two-thirds of pectoral rays flexible; pectoral rays 23 to 27, with a simple branch extending to tips, the rays not free from membrane near tips; plate 131,D. (Spearfish remora.)
Remora brachyptera (Lowe)[22]

6*b*. Dorsal fin rays 20 to 26; disk larger, its length 37 to 49 percent of standard length; disk extending posteriorly well beyond end of depressed pectoral fin; pectoral rays stiff to their tips in specimens larger than about 150 mm.; pectoral rays 20 to 24; tips of pectoral rays multibranched, the rays free from the membrane near tips; plate 131,E. (Marlinsucker.)
Remora osteochir[23] (Cuvier)

5*b*. Pelvic fins narrowly adnate to abdomen; disk laminae 13 or 14; pectoral fin rays 18 to 21; vertebrae 26; plate 131,G. (White suckerfish.)-----**Remorina albescens**[24] (Temminck and Schlegel)

Genus ECHENEIS Linnaeus

Echeneis Linnaeus, Systema naturae, ed. 10, p. 261, 1758 (type species, *Echeneis neucrates* emended to *naucrates*).

Leptecheneis Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 60, 1864 (type species, *Echeneis neucrates* Linnaeus).

Vertebrae 14+16=30; disk laminae numerous, ranging from 18 to 27; no palatine teeth; oral denticles present; body comparatively elongate, slender, but deeper than in *Phtheirichthys*. Body with dark, lateral, horizontal stripe. This genus contains two species, *E. naucrates* with a world-wide distribution in all tropical seas, and *E. neucratoides*, apparently restricted to the western Atlantic Ocean. They are inshore forms, occurring typically in shallow water.

ECHENEIS NAUCRATES Linnaeus

Plate 131,A

Echeneis neucrates Linnaeus, Systema naturae, ed. 10, p. 261, 1758. (Spelling incorrect, emended to *naucrates*, see Opinion 242, Int. Comm. Zool. Nomencl., vol 5, pp. 23–44, 1954. Type locality, "Pelago Indico.")

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[21] *Echeneis australis* Bennett, Narrative of a whaling voyage around the globe . . ., vol. 2, p. 273, 1840, type locality, not given).

[22] *Echeneis brachyptera* Lowe, Proc. Zool. Soc. London, p. 89, 1839 (type locality, Madeira).

[23] *Echeneis osteochir* Cuvier, Règne animal . . ., ed. 2, vol. 2, p. 348, 1829 (type locality, not given).

[24] *Echeneis albescens* Temminck and Schlegel, Fauna Japonica, Pisces, pt. 6, p. 272, pl. 120, fig. 3, 1850 (type locality, Nagasaki, Japan).

Echeneis naucrates Lacepède, Histoire naturalle des poissous, vol. 3, p. 162, pl. 9, largest fig., 1802.

Echeneis lunata Bancroft, Proc. Comm. Zool. Soc., vol. 1, p. 134, 1830 (type locality, Kingston, Jamaica).

Echeneis vittata Rüppell, Neue Wirbelthiere zu der Fauna von Abyssinien gehörig, p. 82, 1835 (type locality, Red Sea).

Echeneis fusca Gronow *in* Gray, Catalogue of fish collected and described by L. T. Gronow, p. 92, 1854 (in part; type locality, "Oceano Americano").

Echeneis fasciata Gronow *in* Gray, Catalogue of fish collected and described by L. T. Gronow, p. 92, 1854 (type locality, "Mari Mediterraneo"?).

Echeneis guaican Poey, Memorias . . ., vol. 2, p. 248, 1860 (type locality, Cuba).

Echeneis metallica Poey, Memorias . . ., vol. 2, p. 252, 1860 (type locality, Cuba).

Leptecheneis neucrates Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 60, 1864.

Leptecheneis naucrates Jordan and Seale, Bull. U.S. Bur. Fish., vol. 25, p. 411, 1906.

Leptecheneis flaviventris Seale, Occ. Pap. Bishop Mus., vol. 4, No. 1, p. 83, fig. 23, 1906 (type locality, Mangareva Island).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 6 specimens, 88 to 656 mm. in standard length.
Eniwetok Atoll: 3 stations, 7 specimens, 425 to 473 mm.
Rongelap Atoll: 1 station, 1 specimen, 126 mm.

Description.—Counts and measurements were taken from the 14 specimens listed above, ranging from 88 to 656 mm. Dorsal rays 36 to 42, anal rays 34 to 37, pectoral rays 21 to 24; disk laminae 21 to 26; gill rakers on lower limb, excluding all rudiments, 11 to 16.

Head length 17 to 20; snout length 8 to 10; least depth of caudal peduncle 1.8 to 2.7; disk length 23 to 26; disk width 7 to 9; distance from anus to mid-base of hypural 49 to 54; diameter of eye 2.7 to 3.5; all in percent of standard length.

Upper and lower jaws and vomer with large patch of sharp, posteriorly recurved, canine teeth; teeth not markedly different in size, those on outer margin of lower jaw largest; villiform tooth patch on tongue; no palatine teeth.

A comblike fringe of closely set denticles on anterior margin of upper jaw on each side extending from about the symphysis almost to angles of jaw.

Disk spinules elongate, sharply pointed, arranged more or less in 2 to 4 transverse rows on each side of the laminae.

Medial spinelike process located in oval cavity just before the first (anterior) laminae, nearly straight, erect, exposed in smaller specimens, sickle-shaped but embedded in larger ones.

The transformation of the caudal fin in this species is characteristic of the subfamily Echeneiinae. The young have an elongate, mid-

caudal filament that transforms with increase in body length to an arrow-shaped caudal fin and then to the definite fin with a truncate posterior margin and extended outer tips.

Color in alcohol.—Head and body dark brown, or dark grayish brown to black; darker dorsally, lighter ventrally. A dark brown, horizontal lateral stripe, wider than diameter of eye, extends from tip of lower jaw through eye, laterally on body to base of caudal fin. A light area above dark stripe on body on some specimens and a narrow, light stripe just below dark stripe, visible particularly on specimens about 425 to 450 mm. in length.

Pectoral and pelvic fins light in small specimens becoming completely black in the largest specimens; anterior portion of dorsal and anal fin with longest rays light, to or nearly to base in small specimens, remainder of fin black; dorsal and anal fin completely black in almost all larger specimens, only a faint touch of light remaining on three specimens; caudal fin with some white on outer margin in smaller specimens; usually completely darkened in the larger specimens or reduced to a very narrow fringe on outer tip.

Ecology.—This species is commonly taken inshore, in shallow water, and is often captured by hook and line.

Hosts.—None of the specimens from study area were removed from hosts. From the literature and museum records I find sharks, comprising several genera and species, to be the usual host of *E. naucrates*. These hosts include such genera as *Ginglymostoma*, *Galeocerdo*, *Carcharhinus*, *Carcharias*, and *Scoliodon*. Various other hosts are ray, stingray, parrotfish, redsnapper, grouper, carangid, tarpon, barracuda, pompano, and trunkfish.

Remarks.—This species of sharksucker is uniformly and widely distributed in the warmer waters of the Atlantic, Pacific, and Indian oceans.

Genus REMORA Gill

Remora Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 239, 1862 (type species, *Echeneis remora* Linnaeus; see Opinion 242, Int. Comm. Zool. Nomencl., vol. 5, pt. 3, 1954).

Remilegia Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 239, 1862 (type species, *Echeneis scutata* Günther, 1860=*Echeneis australis* Bennett, 1840).

Rhombochirus Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 88, 1863 (type species, *Echeneis osteochir* Cuvier).

Remoropsis Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 88, 1863 (type species, *Echeneis brachyptera* Lowe).

Vertebrae 12+15, sometimes 13+14=27; disk laminae 15 to 28; origin of dorsal fin over or in advance of anal origin; median spinelike disk process just before first laminae laterally compressed, axe-shaped, movable, and situated in a cavity or very short, blunt-tipped, and

rigid; dentition varied, jaws weakly or strongly armed with stout caninelike teeth; pelvic fins broadly adnate to abdomen; body plain, brown, pale, or bluish-brown, lacking horizontal stripes. This genus of sharksucker contains four species, distributed in all tropical seas. Off shore forms typically over deep water.

REMORA REMORA (Linnaeus)

PLATE 131,C

Echeneis remora LINNAEUS, Systema naturae, ed. 10, p. 260, 1758 (type locality, "Pelago Indico").

Echeneis squalipeta DALDORF, Skrint. Naturrh. Selsk., vol. 2, p. 157, 1793, =*Remora osteochir*? (type locality, Atlantic Ocean between the tropics).

Echeneis parva GRONOW, *in* Gray, Catalogue of fish collected and described by L. T. Gronow, p. 92, 1854 (type locality, "Oceano Americano").

Echeneis remoroides BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 9, p. 70, 1855 (type locality, Batoe).

Echeneis postica POEY, Memorias . . ., vol. 2, p. 255, 1860 (type locality, Cuba).

Remora remora GILL, Proc. Acad. Nat. Sci. Philadelphia, p. 239, 1862.

Echeneis nubifera TANAKA, Figures and descriptions of the fishes of Japan, vol. 19, pl. 94, figs. 302, 303; vol. 20, No. 131, p. 360, pl. 97, figs. 304, 305; 1915 (type locality, Japan?).

Rhombochirus osteochir GUDGER, Amer. Mus. Nov., No. 294, p. 3, fig. 2, 1928 (in part).

Echeneis nubibera OKADA and MATSUBARA, Keys to the fishes and fish-like animals of Japan, p. 376, 1938 (spelling error for *E. nubifera* Tanaka).

SPECIMENS STUDIED

Bikini Atoll: Six miles southwest of Enyu Island, in open ocean, from shark, July 18, 1946, Chester Freeland, 3 specimens, 78 to 93 mm.

Description.—Counts and measurements were taken from the three specimens, 78 to 93 mm. Dorsal rays 23 to 26; anal rays 22 to 24; pectoral rays 26 to 30; disk laminae 17; gill rakers, including all rudiments, 5 to 6+26 to 28, total 32 to 35.

Head length 27 to 28; snout length 13; least depth of caudal peduncle 5.1 to 7.1; disk length 37 to 38; disk width 18; all in percent of standard length.

Teeth in jaws and on vomer in villiform patch, small, sharply pointed and slightly recurved inwardly; patch on lower jaw broader, those on outer margin larger.

Oral denticles present on anterior margin of upper jaw, in single row. These extend from each side of symphysis to about three-fifths distance to angles of jaw.

Disk spinules elongate, pointed, and arranged in about 2 transverse rows; spinules directed posteriorly, longest on posterior row.

Medial spinelike process in cavity before first laminae is laterally compressed, short and wide, axe-shaped, rounded on dorso-posterior margin.

Caudal fin moderately forked in smaller specimens, less so in larger ones.

Color in alcohol.—Head and body dark brown; pectoral fin dark brown, lighter near tips; pelvic fin blackish, margin of first ray light near tip; dorsal, anal, and caudal fin nearly uniform dark brown.

Ecology.—Mainly an offshore form, at or near surface over deep water or attached to other fishes in these waters.

Hosts.—The above three specimens were taken from a shark, offshore, over deep water. The literature and unpublished host data in various museum collections indicate that sharks of several species are the most common hosts of *R. remora.* Some of these shark hosts are the tiger shark *Galeocerdo cuvieri;* hammerhead shark *Sphyrna zygaena; Thalassorhinus* sp.; *Carcharhinus* sp.; great blue shark *Prionace glauca;* and the sharpnose shark *Scoliodon.* Other hosts are the devil ray *Manta;* sharptail ocean sunfish *Masturus lanceolatus;* marlin *Makaira* sp.; sailfish *Istiophorus;* and sea turtles.

Remarks.—This species is widely distributed in all warm oceans and known from a number of areas in Oceania, the Phoenix, Fanning and Hawaiian islands, Easter Island, Tahiti, and the Low Archipelago. Two species commonly confused with *R. remora,* particularly the smaller specimens, are *R. brachyptera* and *R. osteochir.* A single character, the total number of gill rakers, will separate *R. remora* from these species; *R. remora* has 28 or more rakers as opposed to 17 or less in related forms.

Order PLECTOGNATHIDA

Suborder BALISTINA

Family ALUTERIDAE

By Loren P. Woods

KEY TO THE SPECIES OF ALUTERIDAE FROM THE NORTHERN MARSHALL ISLANDS AND ADJOINING REGIONS [25]

1*a.* Pelvic spine present.

2*a.* Pelvic spine moveable, dorsal spine not fitting into a groove when depressed.

3*a.* First dorsal spine inserted over middle of eye, 2 rows of small tubercles on its anterior surface, row of long, strong spines pointing outward, curving downward on its postero-lateral edges, 6 to 17 spines per row, spines placed alternately; pelvic spine prominent with radiating spinules; scales of body with 3 to 5 retrorse spines, middle spine largest, those of caudal peduncle long, slender, antrorse. Color of head and body light reddish brown to dark blackish brown; sides of body plain or with numerous dark reddish brown irregular lengthwise fine lines; tip of snout and lips black. Dorsal rays I,30 to 34, anal 27 to 30, pectoral 11 to 14, gill rakers 20 to 23.

[25] Characters used in separating genera are modified after Fraser-Brunner (Ann. Mag. Nat. Hist., ser. 11, vol. 8, pp. 177–181, 1941).

4*a*. Gill opening enclosed in a distinct black spot or blotch, plate 132,C.
Pervagor melanocephalus melanocephalus (Bleeker)

4*b*. Gill opening not enclosed in a black area or spot or at most only a trace of brownish pigment around gill opening.

5*a*. Distal half of caudal fin with blackish cross band. (Marshall Islands.)
Pervagor melanocephalus marshallensis, new subspecies

5*b*. Only distal fourth of caudal fin with blackish cross band. (Johnston Island.)
Pervagor melanocephalus johnstonensis, new subspecies

3*b*. First dorsal spine inserted behind middle of eye; barbs on posterolateral edges very short; pelvic spine slender, tapering; no caudal bristles; spinules on scales arising directly from basal plate, not on pedicle.

6*a*. Soft dorsal fin rays 27, second ray sometimes long and filamentous; upper and middle caudal rays sometimes prolonged and filamentous; profile straight, pelvic spine not extending beyond pelvic membrane in small specimens, slightly beyond in large; scale spinules on caudal peduncle, some antrorse, longer, more slender than those of body. Color of head and body light tan, throat crossed by 2 or 3 indistinct bars; two large brown square-shaped spots on back just under dorsal fin; series of white dots running obliquely posteroventrally from eye, behind insertion of pectoral fin to belly; 4 or 5 broken incomplete lengthwise white or dark spots on sides; pelvic flap margin black; dorsal spine barred; dorsal and anal fins pale, hyaline; caudal fin pale on base and margin, its middle crossed by series of transverse spots and bars. Anal rays 26, pectoral 11.
Paramonacanthus oblongus (Temminck and Schlegel)

6*b*. Soft dorsal fin rays 26, dorsal and anal fins elevated anteriorly; profile straight or convex; pelvic spine extending beyond pelvic membrane; scale spinules of caudal peduncle not enlarged. Color of head and body light brown; snout, back, and upper sides slightly darker; lips pale; three faint bars crossing throat; upper third of eye dark brown; dark brown oval spot about size of eye containing several blackish dots or lengthwise streaks on upper sides below anterior third of dorsal fin; a fainter oval spot, larger and narrower than upper on middle of sides below and slightly posterior to upper; dorsal spine barred; dorsal and anal fins pale, hyaline; caudal fin with 3 faint double transverse bars, two on basal half, one submarginal. Anal rays 26, pectoral 10 or 11.
Paramonacanthus cryptodon (Bleeker)

2*b*. Pelvic spine not movable; dorsal spine long, slender, sometimes armed with posterolateral barbs, inserted over middle of orbit, fitting into a groove when depressed.

7*a*. Snout not produced, mouth terminal, angle of snout profile with lengthwise axis of body 39 to 50 degrees.

8*a*. Patch of strong simple long spines (in males) or brush of numerous shorter more slender spines (in females) on middle of sides below posterior half of dorsal fin; caudal peduncle armed with about 12 rows of short heavy spines directed posteriorly. Color of head and body light greyish brown to dark reddish brown; margin of lips pale, area around mouth blackish, spines on sides and those of

caudal peduncle dark brown or blackish, tips pale; dorsal and anal fins pale, their rays blackish basally; caudal fin black. Dorsal rays I,28; anal 25, pectoral 13, gill rakers 27.

Amanses scopas (Cuvier)

8*b*. No patch of enlarged spines or bristles on middle of posterior part of sides.

9*a*. Caudal peduncle with numerous close-set small fine spinelike or chagreenlike scales; dorsal and anal fins low and rounded in small specimens, elevated anteriorly in large; some specimens with small branched fleshy cirri scallered over sides; size less than 150 mm. Color of head and body light brown to dark brown; cheeks with 6 dark lines radiating from mouth toward eye and gill opening, lower sides with faint round or oval spots, smaller than pupil; iris blackish, rim of orbit darker than ground color; dorsal and anal fins pale, rays brownish basally, usually with a pale spot on caudal peduncle opposite rear base of dorsal and anal fins; caudal fin rays dark brown, membranes pale. Dorsal rays I,33 to 36, anal 29 to 32; pectoral 13 or 14; gill rakers 33 to 44.

Amanses sandwichiensis (Quoy and Gaimard)

9*b*. Caudal peduncle armed with two rows of strong retrorse spines, 2 spines per row; dorsal and anal fins rounded, only slightly elevated anteriorly; no fleshy cirri on body; size greater than 150 mm. Color of head and body greyish brown, everywhere with tiny dark reddish brown dots; upper lip dark along margin, pale band on rest of lip, lower lip almost entirely pale; narrow rim of orbit white; margin of opercular flap blackish; posterior part of sides with 9 or 10 faint dark brown vertical bars, spines and their basal plates on caudal peduncle white; caudal peduncle pale on posterior part in some specimens; dorsal and anal fins pale; caudal fin sometimes with narrow pale line basally, usually its rays dusky brown to tips, membranes pale. Dorsal rays I,34 to 37; anal 30 to 32; pectoral rays 15; gill rakers 30 to 32.

Amanses carolae (Jordan and McGregor)

7*b*. Snout produced, mouth dorsal; angle of snout profile with lengthwise axis of body 24 to 30 degrees; dorsal spine inserted above middle of eye, with small spines on anterior surface, posterolateral surface with row of downward curved barbs; each scale of body with 2 or 3 short sharp pointed retrorse spines, spines on caudal peduncle longer, some antrorse; caudal peduncle deeper than long. Color of head and body pale yellowish, head with greenish lines extending foreward along snout; body with 6 or 7 lengthwise rows of round, yellowish white spots about size of eye, interspaces dark, bluish green; pelvic fin membrane black; dorsal and anal fins pale; caudal fin pale or dusky with oblong black submarginal streak on middle 3 or 4 rays. Dorsal rays I,i,31 or 32, anal i,30 or 31, pectoral i,10 or 11, gill rakers 16.

Oxymonacanthus longirostris (Bloch and Schneider)

1*b*. Pelvic spine absent.

10*a*. Anal rays less than 40; body short, deep, rounded; belly distensible; pelvic obscured; no ventral flap; dorsal spine inserted over posterior margin of eye.

11*a*. Dorsal spine fully erectile, short, unarmed; scales of body with short slender spines, each spine bearing a small round knob on its tip. Color of head and back pale greenish tan, belly white; about 5 rows of brownish dots radiating from eye; sides with 8 lengthwise rows of brownish dots; fins all pale; dorsal rays I,23; anal 24; pectoral 10----------**Brachaluteres taylori**, new species

11*b*. Dorsal spine not fully erectile but enveloped in a loose flap of skin; body smooth in young (up to 25 mm.), no spines visible; large specimens with small sharp-pointed imbedded spines over head and body, those on sides of caudal peduncle elongated, some antrorse; 3 distinct dark grey or dark brown saddles across dorsal surface; round black spot near ventral margin below anterior rim of eye, a larger round black spot at ventral tip of second dorsal saddle above anus, about diameter of eye; spiny dorsal membrane black; dorsal fin rays I,27; anal 24; pectoral 11.

Paraluteres prionurus (Bleeker)

10*b*. Anal rays 40 or more; body elongate, compressed; dorsal snout profile concave; dorsal spine long, slender, unarmed, inserted over middle of eye; caudal peduncle deep, ventral side shorter than upper; scale spines short, close set; dorsal and anal fins high, rounded; caudal fin longer than head. Color of head and body light greyish tan; head and body with intensely black round or oval dots, slightly smaller or slightly larger than pupil; dots of sides with curved light or greyish bars above, below, or behind these bars, sometimes joining to form wavy line; dorsal and anal fins pale, sometimes yellowish caudal fin rays yellowish brown, membranes smoky grey. Dorsal fin rays I,45; anal 48; pectoral 14, gill rakers 39.

Alutera scripta (Osbeck)

Genus PERVAGOR Whitley

Pervagor Whitley, Australian Zool., vol. 6, p. 120, 1930 (type species, *Monacanthus alternans* Ogilby (?=*M. nitens* Hollard)).

PERVAGOR MELANOCEPHALUS MARSHALLENSIS, new subspecies

Figure 152

Holotype.—USNM 140737, Bikini Atoll, Erik Island, western end, ocean reef, March 19, S–46–9, Schultz and Brock, 74 mm.

Paratypes.—USNM 140735, same data as holotype, 4 specimens, 60 to 66 mm.; USNM 140733, Bikini Lagoon off Bikini Island to entrance at Enyu Island, March 11–31, S–46–2, Brock, Marr, Schultz, and crew of USS Bowditch, 1 specimen, 82 mm.; USNM 140734, Bikini Atoll, Enyu Island, lagoon reef at channel entrance, poison, diving and spearing to depth of 20 feet, March 16, S–46–8, Schultz, Brock, and Marr, 2 specimens, 47 and 70 mm.; USNM 140732, Bikini Atoll, lagoon, Bowditch Anchorage off Bikini Island, surface light at night, March 30, S–46–46, Schultz and Brock, 1 specimen, 40.5 mm.; USNM 140740, Bikini Atoll, Romuk Island, ocean reef, April 1, S–46–47, Schultz, 1 specimen, 40 mm.; USNM 140752, Bikini lagoon, eastern end, coral heads at depths of 20 to 25 feet, diving,

spearing, March 26, S–46–42, Schultz and Brock, 3 specimens, 57 to 76 mm.; USNM 140738, Bikini Atoll, Boro Channel, surface light at night, April 6–7, S–46–53, Schultz and Brock, 4 specimens, 39.3–45 mm.; USNM 140736, Bikini Atoll, Airy Island, lagoon reef, April 17, S–46–97, Schultz, 3 specimens, 57 to 68 mm.; USNM 140739, Bikini Atoll, Reer Island, northwest side, lagoon reef, August 12, S–46–332, Herald and Brock, 3 specimens, 41–62 mm.; USNM 140750, Eniwetok Atoll, Southwest Passage, leeward edge of reef, ⅘ mile south of Rigili Island, surface light at night, May 25, S–46–184, Schultz, 1 specimen,

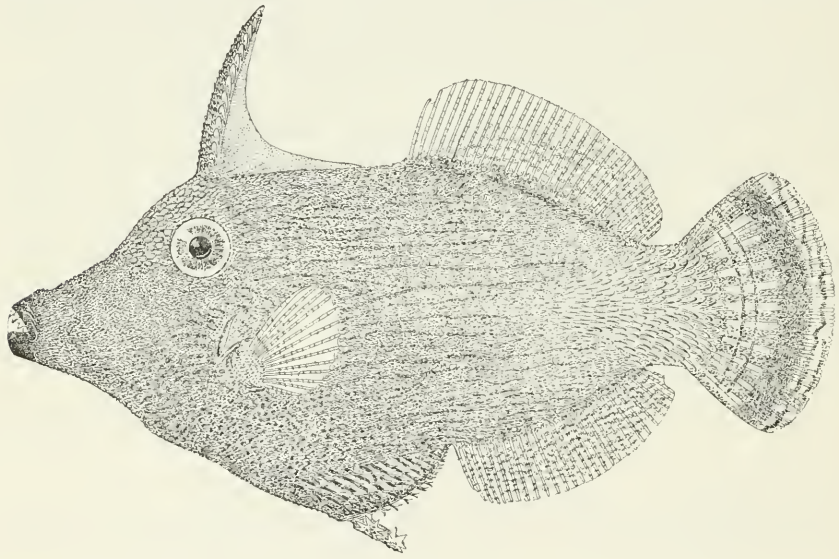

FIGURE 152.—*Pervagor melanocephalus marshallensis*, new subspecies, holotype, USNM 140737, from Bikini Atoll. Drawn by A. M. Awl.

42.2 mm.; USNM 140741, Rongelap Atoll, Arbor Island, western end, ocean reef, June 16, S–46–213, Schultz, 1 specimen, 51 mm.; USNM 140744, Rongelap Atoll, Eniaetok Island, north end, lagoon reefs, June 17, S–46–215, Schultz, 2 specimens, 51 and 60 mm.; USNM 140746, Rongelap Atoll, Mellu Island, lagoon reef, June 19, S–46–220, Schultz and Herald, 8 specimens, 45 to 57 mm.; USNM 140745, Rongelap Atoll, Eniaetok Island, north end, lagoon reef, July 20, S–46–267, Herald and Brock, 1 specimen, 45 mm.; USNM 140743, Rongelap Atoll, Naen Island, west side, lagoon reef, July 30, S–46–302, Herald, 1 specimen, 62 mm.; USNM 140742, Rongelap Atoll, Lomuilal Island, lagoon reef, August 1, S–46–306, Herald, 1 specimen, 66 mm.; USNM 140748, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 1 specimen, 42 mm.; USNM 140747, Rongerik Atoll, Latoback Island, lagoon reef, June 28, S–46–238,

Schultz and Herald, 1 specimen, 40.3 mm.; USNM 140749, Rongerik Atoll, Eniwetak Island, ocean reef in surf, June 29, S–46-241, 3 specimens, 40.7 to 41 mm.; [no catalogue no.], Rongerik Atoll, Bock Pass, surface light at night, June 2, 1946, N–3, Marr, 1 specimen, 40.5 mm.; USNM 140751, Marshall Islands, March–August, 1946, Schultz, 1 specimen, 55 mm.; USNM 140730, Bikini Atoll, Eman Island, channel reef at western end, July 17, S–46–405, Schultz, Brock, Myers, and Hiatt, 5 specimens, 47 to 54 mm.; USNM 140731, Bikini Atoll, Namu Island, lagoon reef, August 6, S–46–508, Schultz, Brock, and Hiatt, 1 specimen, 48 mm.; Bikini Atoll, July 24, 1947, Univ. Washington, 1 specimen, 63 mm.

Description.—Counts or proportion of type given first, range of variation noted in paratypes in parenthesis. Dorsal fin rays I,33 (I,30 to I,34); anal rays 29 (27 to 30); pectoral rays 13 (11 to 14); branched caudal rays 5+5 (always 5+5); gill rakers on first arch 22 (20 to 23); teeth 8 upper, 6 lower jaw.

Depth of body 2.1 (1.8 to 2.2); length of head 2.9 (2.7 to 3.1); both in standard length. Snout 1.3 (1.3 to 1.4); diameter of eye 3.8 (3.5 to 4.3); least depth of caudal peduncle 1.8 (1.8 to 2.7); length of pectoral fin 2.1 (2.2 to 2.8); length of longest dorsal ray 3.1 (2.6 to 4.0); length of longest anal rays 3.3 (2.8 to 4.7); length of middle caudal fin rays 1.7 (1.5 to 1.9); length of soft dorsal fin base 0.9 (0.9 to 1.2); length of anal base 1.1 (1.1 to 1.4); length of dorsal spine 1.3 (1.1 to 1.3); interorbital width 3.3 (3.4 to 3.6); all in length of head. Angle of snout profile 37 (34 to 37) degrees, snout profile concave.

Interorbital area elevated, rounded; mouth terminal; dorsal spine slightly bent at base, almost straight distally, with about 9 rows of small tubercles on anterior face basally, tubercles of 2 rows more prominent than ones continuing to distal tip; 2 rows of long strong spines pointing outward and bent downward on posterior lateral edges 6 to 17 spines per row; pelvic spine prominent, 2 points at tip, only the posterior one moveable, second joint with about 8 outward pointing spines around its edge; pelvic flap moderately developed; scales of head and sides with a row of 3 to 5 retrorse spines, middle spine largest, on caudal peduncle spines much longer, slender, directed posteriorly with tips bent anteriorly, forming hooks; middle teeth broad, pointed in median line, second tooth narrow rounded, third and fourth teeth broad, flat, rounded; dorsal and anal fins low in smallest specimens (40 mm.); elevated anteriorly in larger specimens (50 to 80 mm.); caudal fin rounded, fan shaped.

Color in alcohol.—Ground color of head and body light reddish brown to dark blackish brown; sides of body plain or with numerous dark reddish brown irregular fine lines running lengthwise; tip of

snout and lips black; teeth white with brownish edge; cheeks and area around gill opening and pectoral fin plain brown but usually with numerous close set tiny reddish brown dots (area around opercle not darker than head or body in any of these specimens); pelvic membrane blackish, one or two of paratypes with narrow submarginal blue line, none with black pigment broken up into spots; dorsal fin spine light brownish, lateral spines white, blackish at base; spiny dorsal membrane

TABLE 129.—*Counts recorded for the three subspecies of* Pervagor melanocephalus

Subspecies	Fin rays															Gill rakers				
	Soft dorsal						Anal					Pectoral								
	29	30	31	32	33	34	26	27	28	29	30	11	12	13	14	19	20	21	22	23
melanocephalus	4	13	14	3	1	---	1	10	13	9	2	9	26	1	---	8	3	---	1	1
marshallensis	1	---	18	20	5	1	---	3	12	26	4	1	14	29	1	---	1	5	---	1
johnstonensis	---	---	2	1	---	1	---	---	2	1	1	---	2	6	---	---	---	---	---	---

clouded brownish, its edge black; soft dorsal and anal plain hyaline or more usually with 5 to 9 lengthwise rows of small dots on membranes forming fine lines; pectoral fin pale; caudal fin with rays yellowish on basal half, membranes whitish, double lines forming cross band just basal to middle of fin, then a light area of about the same width, a broad blackish submarginal band present in distal half of caudal fin in all specimens, distal margin pale with two irregular broken fine lines in some specimens.

Color in life.—Of largest paratype 82 mm. ground color of head and body brown; eye yellow; dorsal and anal fins pale yellow, translucent; caudal fin with yellow margin enclosing black lines arranged obliquely; submarginal black band, basal two-thirds orange.

Color of post-larvae.—Six lots of post larvae were collected, three at surface light at night, varying in size from 39.3 to 42.2 mm. Lips pale, top of snout dark greyish brown, cheeks, breast, and lower anterior sides silvery, no dark spot around branchial cleft; rim of dorsal spine groove dark brown; 3 to 5 faint dark reddish brown saddles crossing back and extending downward to about middle of sides, first just behind dorsal spine extending to rim of orbit, second about midway between insertion of dorsal spine and origin of soft dorsal, third under the anterior third of soft dorsal, fourth under the posterior third of soft dorsal and fifth (if present) on caudal peduncle, third and fourth most distinct and join similarly placed narrower bands across ventral surface, interspaces light yellowish brown; 4 or 5 faint narrow lengthwise dark brown lines extending from base of caudal fin anteriorly to origin of soft dorsal where they fade; pectoral, dorsal, and anal fins pale; caudal pale hyaline except in two specimens which have 2

narrow transverse blackish lines crossing middle and distal third of fin; dorsal spine dark greyish brown, its membrane grey.

Remarks.—This subspecies differs from *P. m. melanocephalus* Bleeker (pl. 132,C) of the East Indies chiefly in coloration. *P. m. marshallensis* lacks the oblong blackish spot enclosing branchial cleft, present in all but one of our specimens of *P. m. melanocephalus* including 6 specimens from Samoa and 29 from the Philippines and Dutch East Indies. Only one specimen from the Marshall Islands has a faint black branchial spot and this on one side only. None of the examples from the western Pacific or Samoa have the broad black submarginal caudal band of *P. m. marshallensis.* No significant differences in counts were noted (see table 129).

The color differences that separate these two subspecies are fairly constant with only 2 specimens out of 78 overlapping in the color of the branchial cleft and none in the presence of the black submarginal caudal band. The two forms would be considered separate species were it not for four specimens from Johnston Island that are somewhat intermediate in color pattern since the dark submarginal caudal fin crossband of the Johnston Island examples is much like that of *P. m. melanocephalus.* The general body color of the Johnston Island examples is much darker than either of the other two subspecies.

Named *marshallensis* for the Marshall Islands.

PERVAGOR MELANOCEPHALUS JOHNSTONENSIS, new subspecies

FIGURE 153

Pervagor melanocephalus (not Bleeker) FOWLER and BALL, Bernice P. Bishop Mus. Bull. 26, p. 30, 1925 (Johnston Island).

Holotype.—USNM 140670, Johnston Island, reef along northern side of atoll, August 28–29, S–42–569, Schultz, 99 mm.

Paratype.—USNM 140671, same data as holotype, 3 specimens, 72 to 96 mm.

Description.—Counts or proportions for type are given first, range of variation noted for paratypes are in parentheses. Dorsal fin rays I,34(I,31 or 32); anal fin rays 30 (28 or 29); pectoral rays 13(12 or 13); branched caudal rays 5+5(5+5); teeth 8(8) upper, 6(6) lower jaw.

Depth of body from origin of dorsal to origin of anal 2.3 (2.2 to 2.3); length of head 3.13(2.8 to 3.1); both in standard length. Snout 1.35(1.3 to 1.4); diameter of eye 4.1(3.7 to 4.1); interorbital width 3.2(3.0 to 3.3); length of gill opening 4.1(4.3 to 6.3); postorbital part of head (hind margin of eye to upper edge of gill opening) 5.45(4.9 to 5.6); least depth of caudal peduncle 1.88(1.9 to 2.1); length of pectoral fin 2.8(2.4 to 2.6); length of longest dorsal ray 2.77(2.6 to 2.7); length of longest anal ray 2.9(2.6 to 2.9); length of middle caudal rays

1.73(1.49 to 1.54); length of dorsal fin base 0.88(0.9 to 1.0); length of anal base 1.07(1.08 to 1.22); length of dorsal spine 0.98(1.0 to 1.1); all in length of head. Angle of snout profile 38(36) degrees, snout profile concave.

Interorbital area elevated, rounded; mouth terminal; dorsal spine bent at base bearing on posterior lateral edges, 2 rows of long strong spines, 10 to 15 spines per row, pointing outward and bent downward; pelvic spine moveable at tip, with about 18 outwardly directed spinules around tip; pelvic flap moderately developed, scales of sides with 6 or 7 small spines, connected basally, middle one longest, elongated, directed posteriorly with tips curved anteriorly on caudal peduncle; soft dorsal fin rays low, scarcely elevated anteriorly; caudal fin rounded, fan-shaped.

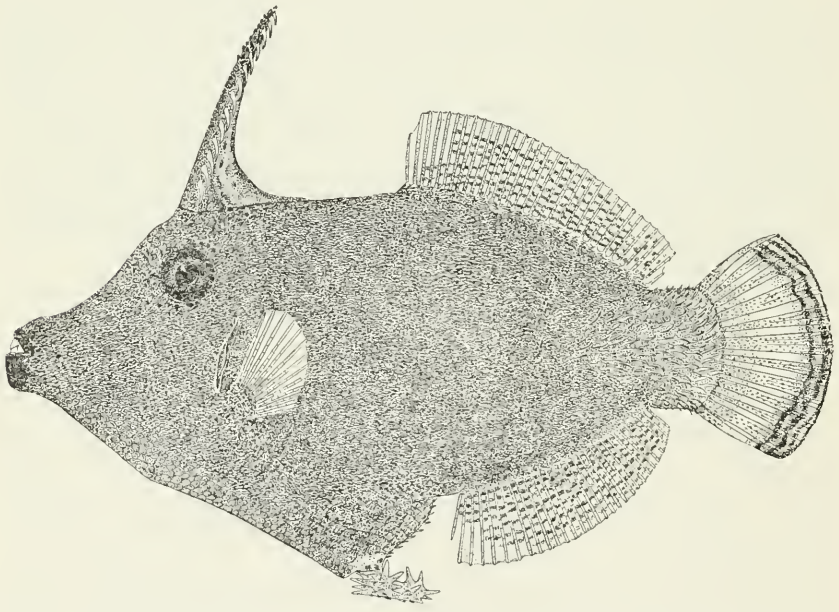

FIGURE 153.—*Pervagor melanocephalus johnstonensis*, new subspecies, holotype, USNM 140670 from Johnston Island. Drawn by A. M. Awl.

Color.—In alcohol, ground color of head and body dark blackish brown, lighter along ventral edge, posterior third of body, and caudal peduncle; lips black; branchial cleft and surrounding area of same color intensity as head and body or nearly so, not forming a definite spot as in *P.m. melanocephalus;* margin of ventral flap pale with narrow black submarginal line; dorsal spine dark brown, tip of spinules white, its membrane uniform dark brown or spotted with dark brown; soft dorsal and anal fin membranes with 8 to 10 narrow wavy lengthwise brown lines, rays light brown; caudal fin with 2 to 4 distinct broken

wavy submarginal lines with interspaces dusky brown forming a narrow faint submarginal dark band, not as wide as in *P.m. marshallensis;* basal three-fourths of fin pale (bright yellow in living specimens); pectoral fin pale, its base blackish.

Remarks.—One example of this subspecies has a slight indication of a dark branchial spot and the dark submarginal caudal band is as narrow as in *P.m. melanocephalus. P.m. johnstonianus* differs from the latter subspecies in having a black area around the gill opening. This new subspecies differs from *P.m. marshallensis* in having a narrow dark submarginal band on caudal fin distally.

Named *johnstonianus* after Johnston Island.

Genus PARAMONACANTHUS Bleeker

Paramonacanthus Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 12, 1866 (type species, *Monacanthus curtorhynchus* Bleeker (?=*M. oblongus* Temminck and Schlegel)).

PARAMONACANTHUS OBLONGUS (Temminck and Schlegel)

Plate 133,B

Monacanthus oblongus Temminck and Schlegel, Fauna Japonica, Pisces, p. 291, pl. 130, fig. 2, 1846 (type locality, Nagasaki).

SPECIMENS STUDIED

Rongelap Atoll: lagoon two miles west of Bush Island, dredge at depth of 120 feet, June 21, S-46-232, Taylor, 2 specimens, 27.5 and 36 mm. in standard length.

Description.—Dorsal rays I,27; anal rays 26, pectoral rays 11; branched caudal rays 5+5.

Depth of body 2.1 to 2.5; length of head 2.65 to 3.1; both in standard length. Snout 1.4 to 1.5; diameter of eye 2.9 to 3.1; least depth of caudal peduncle 2.8 to 3.3; length of pectoral fin 2.9 to 3.1; length of longest dorsal ray 0.8 to 9.5; length of longest anal ray 4.2 to 8.2; length of middle caudal rays 1.0 to 1.2; length of soft dorsal fin base 0.9 to 1.2; length of anal base 1.0 to 1.3; length of dorsal spine 1.4 to 1.5; interorbital width 3.4 to 3.6; postorbital part of head 5.1 to 9.6; length of gill opening 4.7 to 9.6; all in length of head. Angle of snout profile with lengthwise axis of body 29 degrees, snout profile slightly concave in 27.5 mm. specimen, straight in 36 mm. specimen.

Interorbital area flat, ridge rising from center of interorbital to base of dorsal spine; eyes placed high; dorsal spine inserted over posterior margin of eye, dorsal spine slender, anterior surface with minute spines, posterolateral spines strong, pointing downward; pelvic spine small, slender, moveable; pelvic flap short, its margin slightly concave; caudal peduncle about as long as deep; each scale of body with 3 or 4 weak slender pointed spines, scale spines on caudal

peduncle longer, more slender, some antrorse; short branched cirri on body; dorsal and anal fins slightly elevated anteriorly, second dorsal ray of 36 mm. specimen greatly prolonged and filamentous; caudal fin rounded, 36 mm. specimen with two dorsal rays much shorter, giving notched appearance to fin, none of caudal rays prolonged or filamentous.

Color in alcohol.—Ground color of head and body light tan; throat crossed by 2 or 3 indistinct bars; 2 large brown square shaped spots on back, one at base of anterior, one at base of posterior parts of dorsal fin, similar fainter spots at base of anal fin; series of white dots running obliquely posteroventrally from eye, behind insertion of pectoral fin to belly; 4 or 5 broken, incomplete lengthwise rows of small white spots on sides; ventral flap with very dark brown or black margin; dorsal spine with three dark brown bars, dorsal spine membrane dusky, dorsal and anal fins colorless, transparent; caudal fin pale or dusky at base, series of transverse spots and bars on middle of fin giving appearance of large blackish transverse spot, barring fainter distally, fading on margin.

Ecology.—This species was collected in a dredge hauled in lagoon at 120 feet. It is possible that the specimens entered the dredge on their way to the surface.

Remarks.—We believe these specimens are immature representatives of *Paramonacanthus oblongus* since they agree with that species in shape, number of fin rays, and certain points of color and pattern. Our Marshall Island specimens, however, lack the prolonged filamentous rays of the caudal fin, characteristic of *P. oblongus*. The only other specimens of *P. oblongus* in the U.S. National Museum are 65 and 84 mm. in standard length.

PARAMONACANTHUS CRYPTODON (Bleeker)

PLATE 133,A

Monacanthus cryptodon BLEEKER, Nat. Tijdschr. Nederl.-Indie, vol. 8, p. 439, 1855 (type locality, Amboina).

SPECIMENS STUDIED

Bikini Atoll: Bikini lagoon, 4 miles south of western end of Bikini Island, dredge in 168 feet, April 24–25, S–46–115, Morrison and Ladd, 1 specimen, 39.5 mm.

Rongelap Atoll: Lagoon, 2 miles west of Bush Island, dredge at depth of 120 feet, June 21, S–46–232, Taylor, 1 specimen, 26 mm.

Description.—Dorsal rays I,26; anal rays 26; pectoral rays 10 or 11; branched caudal rays 5+5; gill rakers and teeth not counted.

Depth of body 1.5 to 2.3; length of head 2.6 to 2.9; both in standard length. Snout 1.3 to 1.7; diameter of eye 2.7 to 3.0; least depth of

caudal peduncle 2.8 to 3.2; length of pectoral fin 2.8 or 2.9; length of longest dorsal ray 3.75 to 4.1; length of longest anal ray 3.9 to 4.2; length of middle caudal rays 1.2 or 1.3; length of soft dorsal fin base 1.1 to 1.2; length of anal fin base 1.1 to 1.3; length of dorsal spine 1.5 to 1.6; interorbital width 3.7 to 4.3; postorbital part of head 9.2 to 9.6; length of gill opening 5.1 to 9.2; all in length of head. Angle of snout profile 27 to 30 degrees, snout profile straight.

Interorbital only slightly elevated above rim of orbit, nearly flat; dorsal fin spine slender, with minute spines, inserted just behind eye; pelvic spine long, slender, with numerous very small straight spines; pelvic spine extending beyond ventral flap; caudal peduncle slightly longer than deep; scales of body each with 3 or 4 short, slightly bent spines, those of caudal peduncle not enlarged; short, branched cirri present on body arranged in about 5 irregular lengthwise rows; dorsal and anal fins elevated anteriorly; caudal fin with posterior margin rounded.

Color in alcohol.—Ground color of head and body light yellowish brown; snout, back, and upper sides, slightly darker; lips pale; three faint bars crossing throat, first just behind chin, third below the eye; upper third of eye dark brown; body with tiny dark dots, cirri blackish; large dark brown oval spot (about size of eye) containing several blackish dots or lengthwise streaks present on upper sides below anterior third of dorsal fin, a fainter oval spot, longer and narrower than upper, on middle of sides below and slightly posterior to upper; dorsal spine pale brown with 4 darker brown bars, dorsal spine membrane dusky brown; dorsal, anal, and pectoral fins pale, outer rays of caudal fin with 10 bars, 3 faint double transverse bars on caudal, two on basal half, the third submarginal.

Ecology.—This species was collected by means of a dredge in 120 and 168 feet on the bottom of the lagoon. It is possible that the fish were taken in the dredge on its way to the surface.

Genus AMANSES Gray

Amanses Gray, Illustrations of Indian Zoology, vol. 2, pl. 98, 1833–34 (type species, *Monacanthus* (*Amanses*) *hystrix* Gray = *Balistes scopas* Cuvier).

AMANSES SCOPAS (Cuvier)

Plate 135,A,B

Balistes scopas Cuvier, Règne animal . . ., vol. 2, p. 373, 1829 (after Lacepède, Histoire naturelle des poissons, vol. 1, p. 389, pl. 18, fig. 1, 1798).

SPECIMEN STUDIED

Marshall Islands: March–August, 1946, Schultz and Herald, 1 specimen, 82 mm.

Description.—Dorsal rays I,28; anal rays 25; pectoral rays 13;

branched caudal rays 5+5; gill rakers 27 on first gill arch; teeth 8 upper, 6 lower.

Depth of body 1.9; length of head 2.85, both in standard length. Snout 1.1; diameter of eye 3.65; least depth of caudal peduncle 1.85; length of pectoral fin 2.15; length of longest dorsal ray 2.65; length of longest anal ray 2.75; length of middle caudal rays 3.4; length of soft dorsal fin base 1.05; length of anal fin base 1.3; length of dorsal spine 1.15; interorbital width 3.3; post orbital part of head 5.7; length of gill opening 2.6; all in length of head. Angle of snout profile with lengthwise axis of body 48 degrees; snout profile concave.

Interorbital area elevated, rounded; dorsal spine long, 2 rows of small sharp spines on anterior face and 2 rows on posterior side; slightly larger dorsal spine inserted above middle of eye; pelvic spine well developed, not moveable, 10 radiating spines, 2 directed anteriorly, 2 posteriorly, 3 on each side; scales of anterior sides with a single vertical row of 4 or 5 slender spines, a patch of strong simple long spines in middle of sides below posterior half of dorsal fin extending to anterior edge of caudal peduncle; caudal peduncle completely covered with many short strong spines; dorsal and anal fins evenly rounded, caudal fin rounded, fan-shaped.

Color in alcohol.—Head and body light greyish brown; margin of lips pale, area around mouth blackish; posterior third of body paler than head; spines on middle of sides and caudal peduncle black, tips pale; spiny dorsal membrane dusky brownish; dorsal and anal fins pale, their rays blackish basally; caudal fin black; pectoral fin pale.

AMANSES SANDWICHIENSIS (Quoy and Gaimard)

PLATE 135,C

Balistes sandwichiensis QUOY and GAIMARD, Voyage autour du monde . . . sur . . . *l'Uranie* et la *Physicienne*, Zoologie, p. 214, 1824 (type locality, Sandwich Islands).

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 10 specimens, 53 to 128 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 88 mm.
Rongelap Atoll: 2 stations, 3 specimens, 51 to 67 mm.
Kwajalein Atoll: 1 station, 2 specimens, 60 to 72 mm.

Description.—Dorsal fin rays I,33 to 36, usually 34 or 35; anal rays 29 to 32, usually 30; pectoral rays 13 or 14, usually 13; branched caudal rays 5+5; gill rakers on first arch 33 to 44. Teeth 8 upper, 6 lower.

Depth of body 1.85 to 1.95; length of head 2.65 to 3.0; both in standard length. Snout 1.1 to 1.3; diameter of eye 3.6 to 4.5; least depth of caudal peduncle 2.5 to 2.9; length of pectoral fin 2.3 to 2.5; length of longest dorsal ray 2.1 to 3.1; length of longest anal ray 2.4 to 3.4; length of middle caudal fin rays 1.4 to 1.8; length of soft

dorsal fin base 0.85 to 1.0; length of anal base 1.0 to 1.2; length of dorsal spine 1.2 to 1.3; interorbital width 3.4 to 3.8; postorbital part of head 4.3 to 4.8; length of gill opening 2.9 to 3.8; all in length of head. Angle of snout profile 41 degrees (young), 46 to 49 degrees (adults), snout profile concave.

Interorbital area elevated, rounded; dorsal spine long, slender, inserted slightly before middle of eye; anterior face of dorsal spine with 4 rows of small tubercles basally, 2 rows distally; a few small spines basally on posterolateral edges, none distally; pelvic spine with no moveable joints at tip, 8 to 10 radiating spines on tip; pelvic flap poorly developed, its length about equal to gill opening; scales of sides with small spines, those of caudal peduncle with fine spines elongated and curved foreward in larger specimens, forming a pad appearing and feeling like felt; some specimens with small branched cirri scattered over sides; dorsal and anal fins low rounded in small specimens (50 to 60 mm.), becoming elevated anteriorly in larger specimens (72 to 128 mm.); caudal fin rounded, fan-shaped.

Color in alcohol.—Head and body pale yellowish or greyish brown to dark brown; lips pale yellowish, area around mouth just behind lips usually blackish; cheeks with about 6 faint dark lines radiating from mouth towards eye and gill opening, fading posteriorly; lower sides with faint round or oval spots, smaller than pupil, ventral flap blackish or darker than ground color of sides, with 1 or 2 irregular wavy black lines; iris blackish, rim of orbit darker than ground color; spinous dorsal membrane dark brown to blackish; soft dorsal and anal fins white with rays brownish basally; caudal fin with pale membrane, dark brown rays; pectoral fin black basally, pale on distal portion.

Remarks.—We believe *A. pardalis* Rüppell (1835) to be a snyonym of *A. sandwichiensis* Quoy and Gaimard since our specimens agree with both the figures and description of Rüppell and the description of Quoy and Gaimard.

AMANSES CAROLAE (Jordan and McGregor)

PLATE 134

Cantherines carolae JORDAN and MCGREGOR *in* Jordan and Evermann, U.S. Nat. Mus. Bull. 47, pt. 2, p. 1713, pl. 258, fig. 633, 1898 (type locality, Clarion Island).

Cantherine carolae JORDAN and MCGREGOR, Rep. U.S. Comm. Fish, 1898, p. 281, pl. 6, 1899 (Clarion Island).

Pseudomonacanthus punctulatus REGAN, Proc. Zool. Soc. London, 1902, p. 298, pl. 25, fig. 2.

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 6 specimens, 201 to 285 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 227 mm.
Eniwetok Atoll: 1 station, 1 specimen, 278 mm.
Rongerik Atoll: 1 station, 1 specimen, 260 mm.

Description.—Dorsal rays I,34 to 37, usually 36; anal rays 30 to 32, usually 32; pectoral rays 15, in all our specimens; branched caudal rays 5+5; gill rakers on first arch 30 to 32 (5 specimens counted).

Depth of body 1.8 to 2.1; length of head 2.8 to 3.5; both in standard length. Snout 1.1 to 1.3, diameter of eye 5.4 to 5.9; least depth of caudal peduncle 2.8 to 2.9; length of pectoral fin 2.5 to 2.7; length of longest dorsal ray 2.4 to 2.6; length of longest anal ray 2.6 to 2.7; length of middle caudal rays 1.7 to 1.9; length of soft dorsal fin base 0.9 to 1.0; length of anal base 1.2; length of dorsal spine 1.5; interorbital width 3.5 to 4.3; postorbital part of head 5.0; length of gill opening 2.3 to 2.8; all in length of head. Angle of snout profile with lengthwise axis of body 37 to 38 degrees, snout profile concave.

TABLE 130.—*Counts recorded for three species of* Amanses

Species	Fin rays																		
	Soft dorsal											Anal							
	28	29	30	31	32	33	34	35	36	37	38	25	26	27	28	29	30	31	32	33
sandwichiensis						3	8	8	1							3	13	3	1	
carolae							2	2	5	1	1						3	1	6	1
scopas	1											1								

Species	Fin rays				Gill rakers									
	Pectoral				27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	
	13	14	15	16										
sandwichiensis	17	3						1	1	2	4	1	2	
carolae			10	1		2	3							
scopas	1				1									

Interorbital area elevated, rounded; dorsal spine long, smooth, straight; tubercles on posterolateral edge poorly developed; dorsal spine inserted over middle of eye; pelvic spine well developed, not moveable at tip, about 10 small radiating spines on tip; pelvic flap equal to or longer than gill opening, scales on sides with 2 rows of short tubercles, 5 or 6 tubercles per row; caudal peduncle with 2 rows of strong antrorse spines, 2 spines per row; dorsal and anal fins slightly elevated anteriorly, caudal fin rounded, fan-shaped.

Color in alcohol.—Ground color of head and body greyish brown, everywhere with tiny dark reddish brown dots; upper lip dark along margin, pale band on rest of lip; lower lip almost entirely pale; narrow rim of orbit white; opercular flap blackish; ventral flap blackish on margin; posterior part of sides with 9 or 10 faint dark brown vertical bars about as wide as diameter of pupil, spines and their basal plates

on caudal peduncle white, caudal peduncle pale on posterior part in some specimens, some with narrow white line along base of caudal fin; dorsal, anal, and pectoral fins pale; caudal fin pale rays dusky basally, yellowish distally or membranes pale and rays dark brown to tip.

Remarks.—This species, long confused with *A. sandwichiensis* of Quoy and Gaimard, is here separated from that species on basis of pectoral fin ray counts (Quoy and Gaimard gave 13 for *sandwichiensis;* all our specimens of *carolae* have 15), larger average number of dorsal and anal fin rays, lower number of gill rakers, presence of strong caudal peduncle spines, constant differences in coloration, and larger size. We do not believe these are simple adult characters. Jordan and Evermann (1905, p. 419) and Snodgrass and Heller (1905, p. 410) stated that caudal spines were possibly developed on adult males only, but 3 of our specimens are females with eggs whose caudal spines are as well developed as are the males.

Jordan and McGregor's *A. carolae* is the oldest name that describes this species, but *carolae* has 1 or 2 more dorsal rays than most of our specimens and is from the eastern Pacific. There are no specimens of *carolae* from the eastern Pacific available for comparison and it may be that *carolae* will prove to be different from Oceania specimens. Snodgrass and Heller (1905) re-examined the type of *carolae* and compared it with a large specimen from Honolulu, finding no difference except in number of dorsal rays. If the eastern and middle Pacific forms prove to be different, the name *P. punctulatus* of Regan (1902) should be applied to specimens of this species from Oceania.

Genus OXYMONACANTHUS Bleeker

Oxymonacanthus Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 13, 1866 (type species, *Oxymonacanthus chrysospilus* Bleeker (= *Balistes longirostris* Bloch)).

OXYMONACANTHUS LONGIROSTRIS (Bloch and Schneider)

Plate 135,D

Balistes hispidus var. *longirostris* Bloch and Schneider, Systema ichthyologiae . . . p. 464, 1801 (on Seba, Locupletissimi rerum naturalium thesauri . . ., vol. 3, p. 20, fig. 19, 1758; type locality, not given).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 10 specimens, 23 to 70 mm. in standard length.
Eniwetok Atoll: 3 stations, 7 specimens, 62 to 69 mm.
Rongelap Atoll: 7 stations, 18 specimens, 33 to 66 mm.
Rongerik Atoll: 1 station, 2 specimens, 61 to 72 mm.
Guam: 1 lot, 2 specimens, 66 to 69 mm.
Likiep Atoll: 1 lot, Univ. Washington, 4 specimens, 65 to 73 mm.

Description.—Dorsal fin rays I,i,31 or 32; anal rays i,30 or 31; pectoral rays i,10 or 11; branched caudal rays 5+5; teeth 4 in upper jaw, 6 lower; gill rakers 16 (2 counts) small, weak, not covering entire arch.

Depth of body 2.7 to 3.1; length of head 2.4 to 2.7; both in standard length. Snout 1.3 to 1.5; diameter of eye 4.9 to 5.6; least depth of caudal peduncle 2.3 to 2.9; length of pectoral fin 3.6 to 4.3; length of longest dorsal ray 4.5 to 6.2; length of longest anal ray 4.2 to 6.0; length of middle caudal rays 2.1 to 2.4; length of dorsal fin base 0.9 to 1.1; length of anal fin base 1.0 to 1.3; interorbital width 4.0 to 4.3; all in length of head. Angle of snout profile with axis of body 24 to 30 degrees, snout profile concave.

Snout long and tubular; mouth dorsal; interorbital convex, rounded; dorsal spine inserted above the middle of the eye; dorsal spine with small spines on anterior surface; posterior lateral surface with row of downward curved barbs, larger than those of anterior face; pelvic spine prominent, not jointed near tip, small pelvic flap present; scales exceedingly small, imbricate; retrorse spines on caudal peduncle numerous, close set, long, slender recurved spines; dorsal and anal fins low and rounded; pectoral fin very small, caudal fin rounded, fan-shaped.

Color in alcohol.—Ground color of head and body pale yellowish white; lips pale, narrow black line almost encircling snout just behind mouth; head with greenish line over eye, a broad greenish line extending forward from eye along side of snout; 2 lines on cheek, upper one extending forward along side of snout, lower one along lower edge of cheek, fading on throat; dark bluish green regular network covering rest of head and body, sides of body with 6 or 7 lengthwise rows of round yellowish white spots about size of eye, spaces between these dots narrower than diameter of dots, bluish green, pattern and color fading out on caudal peduncle; pelvic fin membrane and small area around its base black, with close-set minute white dots; pelvic spine sometimes black on distal portion; dorsal, anal, and pectoral fins pale, transluscent; caudal fin pale or slightly dusky with an oblong black submarginal streak on middle 3 or 4 rays.

Color in life.—Ground color of head and body bright golden yellow; lips pale yellowish; purplish line encircling snout just behind mouth; two blue lines radiating forward from eye along side of snout; space between these lines golden yellow; yellow oblong bars on sides of cheek; eye yellowish with 5 radiating white lines on iris; rows of spots on back and sides golden yellow, interspaces blue; dorsal fin spine yellowish brown, soft dorsal yellowish at base, distal part of fin pale, hyaline; anal fin similarly colored; caudal fin yellowish white with broad black submarginal streak across middle rays.

Genus BRACHALUTERES Bleeker

Brachaluteres Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 13, 1866 (type species, *Aleuterius trossulus* Richardson).

BRACHALUTERES TAYLORI, new species

Figure 154

Holotype.—USNM 140643, Rongelap Atoll, lagoon two miles west of Bush Island, dredged in 120 feet, June 21, S–46–232, Dr. W. R. Taylor, 14.3 mm.

Description.—Figures in parenthesis are proportions in thousandths of standard length. Dorsal rays I,23; anal rays 20; pectoral rays 10; branched caudal rays 5+5; teeth in upper jaw 3, lower jaw 2.

Depth of body 1.65(609); length of head 2.65(378); both in standard length. Snout 1.7(224); diameter of eye 1.95(196); least depth of caudal peduncle 3.2(119); length of pectoral fin 3.2(119); length of soft dorsal fin base 1.17(324); length of anal fin base 1.3(287); length of dorsal spine 1.8(210); interorbital width 1.95(196); all in length of head. Angle of snout profile with lengthwise axis of body approximately 31 degrees, snout profile straight.

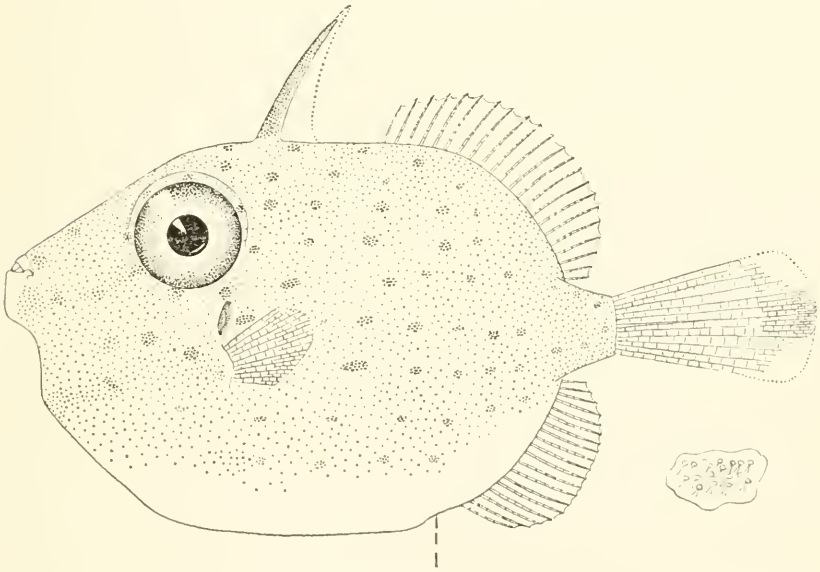

Figure 154.—*Brachaluteres taylori*, new species, holotype, USNM 140643, from Rongelap Atoll. Drawn by A. M. Awl.

Body rounded, shape resembling that of small tetrodont; snout obtuse; belly distensible; pelvic spine absent, pelvis obscured; dorsal spine slender, rough but without barbs, inserted just behind posterior margin of eye; caudal peduncle slender, tapering posteriorly; scales

of body with short slender spines, each spine bearing a small round knob on its tip, those of caudal peduncle not enlarged; body with short, simple cirri on upper sides and back; dorsal and anal fins rounded, not noticeably elevated anteriorly; caudal fin rounded.

Color in alcohol.—Ground color of head and back pale greenish tan; belly silvery white; top of head and upper part of back with small reddish brown dots or elognate dashes more or less arranged in rows and loops, one row extending from anterior margin of eye to rictus, two V-shaped rows crossing interorbital, two rows curving downward and backward from lower margin of eye; sides with about 8 lengthwise rows of dots, two of these extending onto caudal peduncle; fins all pale.

Ecology.—This specimen was taken in 18-inch dredge hauled in lagoon at depth of 120 feet.

Remarks.—This species is very closely related to and may be identical with *Monacanthus oculatus* Günther. It differs, however, in the lower number of fin rays (D.24, A.22, in *M. oculatus*) and from all other described species of *Brachaluteres* in the lower number of fin rays. *B. trossulus* (Richardson) from western Australia, *B. baueri* Richardson from Australia, *B. oculatus* Günther from south Australia, and *B. taylori* from the Marshall Islands are all marked similarly with small spots along the sides arranged in lengthwise rows.

It is with some hesitation that we describe a specimen of this size as new. However, this is the first specimen of this genus to be reported from Oceania, and the distance from the Marshalls to south and western Australia, combined with our lack of knowledge concerning the range of variation in the species of *Brachaluteres*, has caused us to give our specimen a new name.

Named in honor of Dr. William Randolph Taylor of the University of Michigan, who collected the specimen.

Genus PARALUTERES Bleeker

Paraluteres Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 14, 1866 (type species, *Alutarius prionurus* Bleeker).

PARALUTERES PRIONURUS (Bleeker)

Plates 136,A; 142,A

Alutarius prionurus Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 260, 1851 (type locality, Banda; Neira).

SPECIMEN STUDIED

Bikini Atoll: Enyu Island, ocean reef at channel entrance, August 1, S–46–483, Schultz, Brock, and Hiatt, 1 specimen, 25 mm.

Description.—Dorsal fin rays I,27; anal rays 24; pectoral rays 11; branched caudal rays 5+5; teeth 4 upper, 6 lower.

Depth of body 1.6; length of head 2.7; both in standard length. Snout 1.6; diameter of eye 2.68; least depth of caudal peduncle 2.4; length of pectoral fin 2.53; length of longest dorsal ray 2.46; length of longest anal ray 3.04; length of middle caudal fin rays 1.01; length of soft dorsal fin base 1.0; length of anal base 1.1; length of dorsal spine 1.9; interorbital width 2.53; all in length of head. Angle of snout profile 39 degrees, snout profile concave.

Interorbital area flat; mouth terminal; dorsal spine curved, enclosed in sheath of skin; no pelvic shield, belly somewhat distensible; dorsal and anal fins slightly elevated anteriorly; caudal fin long, its distal margin rounded.

Color in alcohol.—Ground color of head and body pale greenish grey, interorbital area darker; black spot near ventral margin below anterior edge of orbit; broad dark greyish band extending from space between spiny and soft dorsal fins downward to pectoral base, a second band from middle of soft dorsal fin downward, abruptly narrowing about middle of sides and ending in a black spot about diameter of eye above anus; a third faint dark bar at posterior base of soft dorsal extending anteroventrally and fading anteriorly, middle of sides with 3 faint irregular lengthwise rows of elongate dots, starting on pectoral base and fading posteriorly; spiny dorsal membrane blackish; soft dorsal and anal fin rays with narrow black line along edge of each ray, tips of rays dusky, membranes pale; caudal fin dusky basally, distal half pale.

Remarks.—This specimen, though small, bears the characteristic markings of the species, agreeing in color pattern and fin ray counts with specimens from the Philippines and Mauritius.

Genus ALUTERA Oken

Alutera Oken, Isis, p. 1183, 1816 (type species, *Balistes monoceros* Linnaeus).

ALUTERA SCRIPTA (Osbeck)

Plate 133,C

Balistes scriptus Osbeck, Reise Nach Ostindien und China, p. 145, 1765 (type locality, China Sea).

SPECIMENS STUDIED

Bikini Atoll: Arji Island, 100 yards off shore, lagoon coral area at depths from 0 to 40 feet, poison and spear, August 7, S-46-308, Brock and Herald, 1 specimen 410 mm. in standard length.

Description.—Dorsal rays I,45; anal rays 48; pectoral rays 14; branched caudal rays 5+5; gill rakers on first gill arch 39; teeth in upper jaw 8, lower 6.

Depth of body 2.9; length of head 3.2; both in standard length. Snout 1.1; diameter of eye 5.5; least depth of caudal peduncle 2.4; length of pectoral fin 3.2; length of longest dorsal ray 4.0; length of longest anal ray 4.0; length of middle caudal rays 0.7; length of soft dorsal fin base 0.9; length of anal fin base 0.8; length of dorsal spine 1.6; interorbital width 4.4; postorbital part of head 6.1; length of gill opening 3.6; all in length of head. Angle of snout profile with lengthwise axis of body 25 degrees, snout profile concave.

Interorbital area elevated, sharp angle on middorsal line; dorsal fin spine long, slender, unarmed, inserted over middle of orbit; pelvic spine absent (in specimens this size); caudal peduncle slightly longer than deep, ventral side of caudal peduncle shorter than upper; body uniformly covered with short close-set spines, those of caudal peduncle not enlarged; slight hump present on dorsal part of snout near tip; dorsal and anal fins high rounded; caudal fin long, its tip rounded.

Color in alcohol.—Ground color of head and body light greyish tan; head with scattered, round, intensely black dots smaller than pupil, two rows of these dots encircling mouth; 8 wavy greyish or black lines (sometimes interrupted) on head, the lower five radiating posteriorly along cheeks and breast, one reaching lower rim of orbit and almost completely encircling eye counter-clockwise; two short interrupted lines before eye and one on interorbital area; pectoral axil and surrounding area dark brown with several black round dots; body with intensely black dots as large or larger than pupil, round, kidney shaped, or elongate, running either lengthwise or vertical; those of back round, more or less arranged in two lengthwise rows with grey or black curved bar with rounded ends above each dot, two rows along lower sides similarly arranged with curved bars below, these bars sometimes joined, forming a wavy greyish line; black spots on middle of sides with larger bars, mostly black; dots on caudal peduncle with curving bars around posterior edge, some dots nearly completely encircled; dorsal and anal fins pale, anal with faint yellowish color, caudal fin rays light yellowish brown, membranes smoky grey.

Family BALISTIDAE

By Loren P. Woods

KEY TO GENERA AND SPECIES OF BALISTIDAE FROM THE NORTHERN MARSHALL ISLANDS AND ADJOINING REGIONS[26]

1*a*. Scales just behind gill opening above pectoral base not enlarged and plate-like. Cheeks completely scaled, without grooves; short shallow groove

[26] Modified after Fraser-Brunner, Ann. Mag. Nat. Hist., ser. 10, vol. 15, p. 658, 1935.

before eye below nostril; pelvic spine not moveable; each scale of head and body with elongate, slender, median, retrorse spine and a smaller spine on each side (juvenile character); dorsal and anal fins high, rounded; ground color light brown, head with darker brown dots and body with dark brown interrupted lines in irregular lengthwise rows; a ring of small dots around orbit; opercle with dots or short lines; soft dorsal and anal fins uniform brown or with dark brown membranes, lighter colored rays and distal margin pale; caudal fin membranes blackish, upper and lower rays lighter and distal margin pale; dorsal rays III–ii, 24 or 25; anal i,22 or 23; pectoral i,13 or 14; scale rows 39 to 42; gill rakers on first arch 26----------**Canthidermis senticosus** (Richardson)

1*b*. Scales just behind gill opening above pectoral base enlarged and platelike, except in *Balistoides viridescens*.

2*a*. Short deep groove before eye below nostril.

3*a*. Teeth uneven, notched; third dorsal spine well developed.

4*a*. Dorsal and anal fins low and rounded, not angulate or elevated anteriorly.

5*a*. Profile straight; 7 to 10 rows of small spines on caudal peduncle; caudal fin truncate or slightly emarginate; first dorsal spine laterally compressed, no lateral flange along outer margin.

6*a*. Tubercles not developed on scales of sides of body anterior to origin of soft dorsal fin.

7*a*. A patch of large rectangular scales on cheek, larger than those of body, 6 scale rows deep and 8 to 10 scales per row; tubercles on scales of sides extending forward to about the soft dorsal origin; head and body light greyish brown with scattered small, indistinct, irregular patches of darker greenish brown; faint straight yellowish line extending from rictus to vertical from eye, similarly colored line across throat just behind chin connecting two side lines (bridlelike); lips pale greyish; soft dorsal fin light olive brown; anal fin pale yellowish white; caudal fin with upper and lower edges and distal margin dark brown, middle part of fin pale greenish; dorsal rays III–ii,26; anal ii,24; pectoral i,13; scale rows 52; gill rakers on first arch 33---**Sufflamen capistratus** (Shaw)

7*b*. All scales on cheek smaller than those of body; tubercles on sides of body not extending farther forward than posterior half of soft dorsal; head and body dark brown; lips pale; two pale cross bands on chin, one just behind lips, narrow and distinct, the second broader, diffuse, on under side of chin; soft dorsal and anal fins pale, transluscent; caudal fin with upper and lower rays white, broad crescent-shaped band along distal margin, middle part of fin dark brown; dorsal rays III–ii,24 or 25; anal ii,22 or 23; pectoral i,12; scale rows 45 to 47; gill rakes on first arch 25 to 27-------**Sufflamen chrysoptera** (Bloch and Schneider)

6*b*. Tubercles developed on sides of body forward to below origin of second dorsal spine; cheek scales not enlarged, smaller than scales of body; head and body pale yellowish white; a straight narrow white line extending from corner of mouth past lower edge of pectoral base, usually reaching anal fin origin but sometimes fading before reaching this point; greyish wedge-

shaped spot from spiny dorsal through posterior part of eye to lower edge of pectoral base; a second stripe from below middle of spiny dorsal across enlarged scales behind opercular opening; pubic spine and ventral flap blackish with faint white basal line; soft dorsal and anal fins pale; caudal fin greyish basally, pale distally.

Sufflamen bursa (Bloch and Schneider)

5*b*. Profile convex; 3 to 5 rows of spines on caudal peduncle; caudal fin rounded, fan-shaped; tubercles on body well developed on 4 or 5 transverse scale rows anterior to soft dorsal origin; first dorsal spine flat on anterior sides, with lateral flange bearing laterally directed teeth; lips pale yellow, brown line encircling mouth, back of this a thin yellow line; snout, chin, and interorbital dark brown; broad yellow band extending from below preorbital anteriorly across snout profile to below preorbital groove on opposite side; body dark brown, lower sides with large round white spots, larger than eye; broad saddle on back and upper sides extending from posterior part of eye to origin of soft dorsal, its ground color yellowish orange and dotted with numerous small close-set brown spots; dorsal and anal fins pale; caudal fin dark brown on base, upper, and lower rays, broad submarginal band, middle part of fin yellowish, tips of rays white; dorsal rays III–ii,25; anal i,22; pectoral i,13; scale rows 48; gill rakers on first arch 37.

Balistoides niger (Bonnaterre)

4*b*. Dorsal and anal fins high, elevated and angulate anteriorly.

8*a*. Caudal peduncle armed with 6 rows of short heavy antrorse spines, upper and lower rows with 1 to 5 spines per row, 3 middle rows 7 to 11 spines per row; interorbital elevated, convexly rounded; caudal fin truncate or rounded; area around mouth behind lips, and wide groove extending back from rictus, naked; ground color of head and body pale greyish yellow to golden yellow; upper lips and naked area behind lips black, black color extending from rictus posteriorly in and along sides of shallow groove; soft dorsal and anal fins with narrow black basal band, broad median portion of fin pale orange or yellowish, broad marginal portion of fins with rays black, membranes pale; pectoral fin similarly colored; caudal fin black basally and on upper and lower margins, middle of fin yellow, distal margin broadly black; dorsal rays III–ii,23 or 24;anal ii, 21 to 23; pectoral i,13; scale rows 33 or 34; gill rakers on first arch 42 or 43.

Balistoides viridescens (Bloch and Schneider)

8*b*. Caudal peduncle not armed; scales of caudal peduncle not modified; interorbital low, rounded; caudal fin with upper and lower rays much elongated; broad area around mouth and anterior part of cheeks naked; 4 rows of scales on cheeks reduced to small widely separated tubercles; space between rows naked; ground color of head pale yellowish brown; head scales grey; interorbital area and nape with short wavy transverse lines; indistinct short lines radiating from eye; body with fine regular brown network outlining scales, center of each scale with small round yellowish white spot; soft dorsal and anal fins with reticulated pattern; broad distal margin of fins

white; pectoral fin grey with broad pale margin; caudal fin with light spots on basal three-fourths, upper and lower rays uniform brownish grey to tips, middle rays with broad white margin and narrow black submarginal band. Dorsal rays III–ii,24; anal ii,20; pectoral i,13; scale rows 45; gill rakers on first arch 34__**Pseudobalistes fuscus** (Bloch and Schneider)

3*b*. Teeth even and incisorlike, dorsal and anal fins elevated anteriorly, angulate; third dorsal spine minute, not reaching above rim of spiny dorsal groove; head and body dark reddish brown to blackish.

9*a*. Soft dorsal and anal fin uniform dark brown except for a white line at base; caudal fin dark brown, a thin white submarginal line following outline of fin; dorsal rays III–ii,32; anal ii,28; pectoral i,15; scale rows 66; gill rakers on first arch 36; 9 lengthwise ridges on posterior part of body, only 4 of these extending onto caudal peduncle; upper and lower caudal rays elongate; head and body uniform dark reddish brown to black_____**Melichthys radula** (Solander) [27]

9*b*. Soft dorsal and anal fins pale or white except outer margins bordered by black band; caudal fin pale or whitish except dorsal and ventral edges with a dark line; posterior part of caudal peduncle pale; pectoral pale, its base blackish or brownish.

Melichthys vidua (Solander)

2*b*. No deep groove before eye.

10*a*. Third dorsal spine well developed, projecting above rim of dorsal groove; caudal peduncle not constricted, its depth 2.8 to 2.95 in head; caudal peduncle armed with two rows of strong retrorse spines, 3 or 4 spines per row; ground color of head and body light greyish brown to dark brownish black; lips dark brown, the lower with a transverse light line; light line across chin running posteriorly along lower cheek and joined by faint light line coming from anterior part of snout just behind lips; thin light lines crossing snout extending obliquely downward and backward across cheek; light lines curving around base of dorsal in widening concentric curves covering entire side; caudal peduncle spines black, the area around these spines jet black; pectoral, soft dorsal, and anal fins pale whitish; upper and lower unbranched caudal rays with black outer margin, middle rays dusky, membranes pale; dorsal rays III–ii,23 or 24; anal i,22 or 23; pectoral i,12; scale rows 43 to 46; gill rakers on first arch 36 to 40.

Balistapus undulatus (Mungo Park)

10*b*. Third dorsal spine minute, not projecting above rim of dorsal groove; caudal peduncle constricted, its depth 4.0 to 5.3 in head, and armed with 3 or 4 rows of spines, middle 2 rows with 8 to 12 spines per row.

11*a*. Caudal peduncle spines contained in a definite black triangular patch; usually 4 rows of spines, upper and lower rows with 4 to 8 spines per row and middle rows with 8 to 10 spines per row; color of head and body pale yellowish white; grey interorbital band with three darker transverse lines; dark band slightly narrower than eye, extending from lower edge of orbit, broaden

[27] Not yet found in northern Marshall Islands.

ing ventrally to include base of pectoral, then extending posteroventrally to anterior two-thirds of anal base, upper margin of this dark band pale, with a light grey line running from middle third of body band to posterior dorsal base; triangular black patch on caudal peduncle joining an encircling dark band posteriodorsally, with margins pale; area around anus black; pectoral, dorsal, and anal fins pale; caudal fin pale, rays dusky; dorsal rays III–ii,21 or 22; anal i,20; pectoral i,12; scale rows 39 to 43; gill rakers on first arch 23 or 24.

Rhinecanthus rectangulus (Bloch and Schneider)

11*b*. Caudal peduncle spines black but not contained in a black triangular patch but in oblong white area; 3 rows of strong antrorse spines, 2 upper rows each with 10 to 12 spines of about equal length, lower row one-half to one-third length of upper with 3 to 5 spines; ground color of upper parts of head and body light greyish brown, of lower parts pale yellowish white; blue bordered or pale bordered black band from interorbital to pectoral base; anus black; a black patch with diffuse edges extending from base of pectoral dividing into two branches, one to origin of soft dorsal, the other to posterior base of soft dorsal; from lower edge of patch, 4 lines extend obliquely posteroventrally, the first, broad, extending to anus, the second, narrow, fading below, the third, broad, reaching middle anal fin base, the fourth, narrow, fading below; pectoral, dorsal, and anal fins pale, caudal fin pale dusky; dorsal rays III–ii,23 or 24; anal i,21 or 22; pectoral i,12 or 13; scale rows 41 or 42; gill rakers on first arch 21 to 25.

Rhinecanthus aculeatus (Linneaus)

Genus CANTHIDERMIS Swainson

Canthidermis Swainson, Natural history and classification of fishes . . ., vol. 2, pp. 194, 325, 1839 (type species, *Balistes angulosus* Quoy and Gaimard).

CANTHIDERMIS SENTICOSUS (Richardson)

Plate 138,A

Balistes senticosus Richardson, Zoology of the voyage of H.M.S. *Sulphur* and *Samarang*, Fishes, p. 23, pl. 9, figs. 5–8, 1848 (type locality, China Sea).

SPECIMENS STUDIED

Eniwetok Atoll: Eniwetok Island, lagoon, April 1945, Richard G. Miller, 4 specimens, 30 to 46 mm.

Description.—Dorsal fin rays III—ii,24 or 25, anal rays i,22 or 23; pectoral rays i,13 or 14; branched caudal rays 5+5; gill rakers on first gill arch 26 (one count), long, very slender; scale rows from upper edge of gill opening to base of middle caudal rays 39 to 42; teeth in upper jaw 8, lower jaw 8, notched.

Depth of body 1.55 to 1.7; length of head 2.5 to 2.7; both in standard length. Snout 1.8 to 2.05; diameter of eye 3.25 to 3.4;

least depth of caudal peduncle 2.5 to 2.9; length of pectoral fin 2.3 to 3.0; length of longest dorsal ray 1.65 to 1.75; length of longest anal ray 1.7 to 1.85; length of caudal fin 1.65 to 2.0; interorbital width 2.15 to 2.45; all in length of head. Angle of snout profile 45 to 47 degrees, convex.

Short shallow groove before eye below nostrils; interorbital flat with slight median ridge, third dorsal spine well developed, scales behind gill opening not enlarged or platelike; each scale with an elongate slender median retrorse spine and a smaller spine on each side; median or lateral spines may be bifurcate; caudal peduncle spines no larger than those on other parts of body; pelvic spine not moveable; caudal fin rounded; dorsal and anal fins high, rounded, slightly elevated anteriorly.

Color in alcohol.—Ground color of head and body light brown; head with darker brown dots and body with darker brown interrupted lines arranged in irregular lengthwise rows, some lines slightly bent or wavy, others enlarged on one end, others oval dots; a ring of small dots around orbit and on opercle, sometimes forming short lines; spiny dorsal fin membrane dark brown to brownish black; soft dorsal and anal fins uniform brown or with dark brown membranes, lighter rays and distal margin pale; caudal fin membranes blackish, upper and lower rays lighter, distal margin pale.

Remarks.—These specimens apparently belong to the species shown both by Richardson and by Weber (*Siboga*-Expeditie, vol. 57, pl. 10, fig. 14, 1913). We have compared those from the Marshall Islands with specimens from Panama, Japan, the Philippines, and the Indian Ocean, which bear a reticulated brown pattern and small white spots (*C. rotundatus* (Procé)?), and find a constant difference in the number of dorsal and anal fin rays (see table 131). It is not possible for us, on the basis of specimens available in the U.S. National Museum, to name the adult species of which *C. senticosus* is the juvenile.

Genus SUFFLAMEN Jordan

Sufflamen Jordan, Copeia, no. 29, p. 27, 1916 (new name for *Pachynathus* Swainson, 1839, preoccupied; type species, *Balistes capistratus* Shaw).

SUFFLAMEN CAPISTRATUS (Shaw)

Plate 138,C

Balistes capistratus Shaw, General zoology, vol. 5, p. 417, 1804 (based on "le Baliste bride" of Lacepède, Histoire naturelle des poissons, vol. 1, pp. 335, 378, pl. 15, fig. 3, 1798; type locality, not given).

SPECIMEN STUDIED

USNM 139850, Marianas Islands, Rota Island, Nov. 15, 1945, D. G. Frey, 1 specimen, 183 mm.

748-328—66——8

Description.—Dorsal fin rays III–ii,26; anal rays ii,24; pectoral rays i,13; branched caudal rays 5+5; gill rakers on first gill arch 33, long, slender, pointed; scale rows 52; teeth in upper jaw 8, lower jaw 8, inclined toward median line, slightly protruding, notched.

Depth of body 2.0; length of head 2.65; both in standard length. Snout 1.3; diameter of eye 6.1; least depth of caudal peduncle 4.6; length of pectoral fin 3.35; length of longest dorsal ray 3.2; length of longest anal ray 3.5; length of caudal fin 3.2; interorbital width 4.35; all in length of head. Angle of snout profile 29 degrees, snout profile straight.

TABLE 131.—*Comparison of number of dorsal and anal rays of 2 species of* Canthidermis

Species	Dorsal rays					Anal rays				
	23	24	25	26	27	20	21	22	23	24
rotundatus	2	10	2			1	9	4		
senticosus				2	3				4	1

Nostrils set in shallow groove, below this a deeper groove before eye; upper orbital rims prominent, interorbital slightly convex; enlarged platelike scales behind branchial opening just above pectoral axil; a patch of enlarged, rectangular scales on cheek about 6 rows deep and 8 to 10 scales wide, these scales larger than those of body; about 7 rows of short antrorse spines on caudal peduncle; scales of anterior side of body, back, and belly smooth, not bearing short spine or enlarged tubercle; soft dorsal and anal fins low, rounded, not elevated anteriorly; caudal fin subtruncate, slightly emarginate; pectoral fin short, rounded.

Color in alcohol.—Head and body light greyish brown with scattered small indistinct irregular patches of darker greenish brown, dorsal part of back darker than sides and belly; faint straight yellowish white line running from rictus to vertical from eye; similarly colored line across throat just behind chin connecting two side lines; lips pale greyish; soft dorsal fin light olive brown; anal fin pale yellowish white; caudal fin color of body, ground color on median portion, upper and lower edges and narrow distal margin brown.

SUFFLAMEN CHRYSOPTERA (Bloch and Schneider)

PLATE 137

Balistes chrysopterus BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 266, 1801 (based on *B. armi* of Lacepède, Histoire naturelle des poissons, vol. 1, p. 382, pl. 18, fig. 2, 1798; type locality, Indian Ocean).

SPECIMENS STUDIED

Bikini Atoll: Enyu Island, lagoon reef at channel entrance, poison, diving and spear to depth of 20 feet, March 19, S–46–8, Schultz, Brock, and Marr, 1 specimen, 97 mm.

Rongelap Atoll: Kieshiechi Island, north end, lagoon coral head at depth of 20 feet, poison and spear, July 24, S–46–285, Brock and Herald, 2 specimens, 78 and 113 mm.

Description.—Dorsal fin rays III–ii,24 or 25; anal rays ii,22 or 23; pectoral rays i,12; branched caudal rays 5+5; gill rakers on first arch 25 to 27 (2 counts), long, slender, tapering; scale rows 45 to 47; teeth in upper jaw 8, lower jaw 8, notched.

Depth of body 1.85 to 1.95; length of head 2.6 or 2.7; both in standard length. Snout 1.3 to 1.5; diameter of eye 4.6 to 5.0; least depth of caudal peduncle 4.2 to 4.4; length of pectoral fin 2.75 to 3.3; length of longest soft dorsal ray 2.5 to 2.7, length of longest anal ray 2.7 to 3.0; length of caudal fin 1.7 to 2.0 interorbital width 4.1 to 4.3; all in length of head. Angle of snout profile with lengthwise axis of body 31 or 32 degrees, snout profile almost straight in smallest specimen, slightly concave in largest.

Groove present before eye below nostril; interorbital flat; third dorsal spine small; caudal peduncle with 7 to 10 rows of small spines; cheek scales not enlarged, smaller than scales of body; fringe of short fleshy cirri around corners of mouth just back of lips in largest specimen.

Color in alcohol.—Head and body dark brown; lips pale; two pale cross bands on chin, one narrow and distinct below lower lip, the other broader, diffuse, on under side of chin; spiny dorsal membrane dark brown between first and second dorsal spines, dark basally, pale distally between second and third spines; soft dorsal, anal, and pectoral fins pale, their rays dusky; caudal fin with upper and lower rays white, with broad white, crescent-shaped band along distal margin, middle part of fin dark brown.

SUFFLAMEN BURSA (Bloch and Schneider)

PLATE 138,B

Balistes bursa BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 476, 1801 (on Baliste bourse Rozier; type locality, Indies).

SPECIMEN STUDIED

Bikini Atoll: Eman Island, channel reef at western end, July 17, S–46–405, Schultz, Brock, Myers, and Hiatt, 1 specimen, 118 mm. (USNM 140625).

Description.—Dorsal fin rays III–ii,25; anal rays i,24; pectoral rays i,13; branched caudal rays 5+5; gill rakers on first arch 22; scale rows 48; teeth notched, 8 in upper jaw, 8 in lower.

Depth of body 2.0; length of head 2.7; both in standard length. Snout 1.3; diameter of eye 5.4; postorbital part of head 5.3; least depth of caudal peduncle 3.8; length of pectoral fin 3.2; length of longest soft dorsal ray 2.7; length of soft dorsal base 1.2; length of longest anal ray 3.3; length of anal base 1.3; length of caudal fin 1.7; interorbital width 3.5; all in length of head. Angle of snout profile with lengthwise axis of body 35 degrees, snout profile straight.

Shallow wedge-shaped groove present before eye and below nostril; interorbital slightly rounded; third dorsal spine 3.0 in first dorsal spine; caudal peduncle with 6 rows of small antrorse spines; tuberculated scale rows extending forward on body to below second dorsal spine; cheek scales not enlarged, smaller than scales of body.

Color in alcohol.—Head and body pale yellowish white, lips pale, a straight, narrow white line extending from corner of mouth below lower edge of pectoral base, fading on this specimen before reaching anal fin origin; greyish wedge-shaped spot from spiny dorsal through posterior part of eye to lower edge of pectoral base; a second stripe from below middle of spiny dorsal across enlarged scales behind opercular opening; pubic spine and ventral flap blackish with faint white basal line. Spiny dorsal membranes dusky between first and second spines; soft dorsal and anal fins pale, their scaly basal sheath light greyish; caudal fin dark greyish basally, pale distally; pectoral fin pale.

Genus BALISTOIDES Fraser-Brunner

Balistoides Fraser-Brunner, Ann. Mag. Nat. Hist., ser. 10, vol. 15, p. 662, 1935 (type species, *Balistes viridescens* Bloch and Schneider).

BALISTOIDES NIGER (Bonnaterre)

Plate 144,D

Balistes niger Bonnaterre, *in* Encyclopédie méthodique, tableau encyclopédique et méthodique des trois règnes de la nature . . ., Ichthyologiae, p. 19, pl. 85, fig. 352, 1788 (type locality, Isle de France or Mauritius).

Balistes conspicillum Bloch and Schneider, Systema ichthyologiae . . ., p. 474, 1801.

Balistes niger Kendall and Goldsborough, Mem. Mus. Comp. Zool., vol. 26, no. 7, p. 333, 1911.

SPECIMEN STUDIED

Jaluit Atoll: Jan. 31 to Feb. 4, 1900, *Albatross*, 1 specimen, 220 mm.

Description.—Dorsal fin rays III–ii,25; anal rays i,22; pectoral rays i,13; branched caudal rays 5+5; gill rakers on first arch 37 (counting all rudiments); scale rows 48; teeth in upper jaw 8, lower jaw 8.

Depth of body 2.0; length of head 3.0; both in standard length. Snout 1.4; diameter of eye 4.9; least depth of caudal peduncle 4.5; length of pectoral fin 2.55; length of longest dorsal ray 3.15; length of longest anal ray 3.3; length of middle caudal rays 2.0; interorbital

width 2.95; all in length of head. Angle of snout profile with axis of body 31 degrees; snout profile straight, profile convex from interorbital to origin of first dorsal.

Preocular groove short, deep; orbital rims not prominent; interorbital smoothly rounded; 5 plates behind gill opening, not larger than body scales; scales of cheeks smaller than those of body; space just behind lips naked, consisting of rugose skin or short fine pointed fleshy tabs of skin; caudal peduncle armed with 3 to 5 rows of short heavy antrorse spines, upper and lower rows with 1 or 2 spines per row, 3 middle rows with 5 to 10 spines per row; tubercles present on scales on middle of sides of body forward to insertion of soft dorsal fin; soft dorsal and anal fins low, outlines convex, anterior portion not elevated, caudal fin very broad and rounded.

Color in alcohol.—Lips pale yellowish, narrow brown band encircling mouth just behind lips and a thin yellow line encircling mouth just posterior to brown band; chin, upper part of cheeks, and snout dark brown; interorbital blackish; a broad yellow band running from below eye anteriorly across profile of snout to preorbital groove on other side; lower part of cheek with yellowish white spots larger than eye, the smallest about the size of eye; interspaces between these spots dark brown, dark brown color sometimes not completely encircling spots; broad saddle on back around spiny dorsal, extending from interorbital area to soft dorsal fin and ventrally to just below level of lower rim of orbit, its ground color yellowish orange, with numerous small close-set dark brown spots of varying sizes, some smaller than pupil, some as large as two scales; rest of body ground color dark brown, lower sides and belly with large round white spots; caudal peduncle yellowish white over sides, dorsal part, and around upper caudal base, brown along ventral side, spines of caudal peduncle blackish; spiny dorsal membrane very dark brown, its border blackish; soft dorsal and anal fins uniform yellowish, pectoral fin pale yellowish; caudal fin with broad dark brown basal band, upper and lower rays dark brown, middle portion of fin yellowish, then a broad submarginal brown band, distal narrow margin of fin white.

BALISTOIDES VIRIDESCENS (Bloch and Schneider)

PLATE 139

Balistes viridescens BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 477, 1801 (based on "le Baliste verdatre" of Lacepède, Histoire naturelle des poissons, vol. 1, pp. 335, 378, pl. 16, fig. 3, 1799; type locality, Mauritius).

SPECIMENS STUDIED

Eniwetok Atoll: lagoon off southeast end of Eniwetok Island, Bowditch Anchorage, hook and line, May 20 to June 6, S-46-154, Welsh and Schaefer, 2 specimens, 415 and 435 mm.

Bikini Atoll: lagoon half mile off Bikini Island, hook and line, July 20 to Aug. 10, S–46–458, Schultz and crew of USS Chilton, 1 specimen, 460 mm.

Description.—Dorsal fin rays III–ii,23 or 24; anal rays ii,21 to 23; pectoral rays i,13; branched caudal rays 5+5; gill rakers on first arch 42 or 43 (2 counts, counting all rudiments); scale rows 33 or 34; teeth in upper jaw 8, lower jaw 8.

Depth of body 2.1 to 2.3; length of head 2.8 or 2.9; both in standard length. Snout 1.3 to 1.4; diameter of eye 7.0 to 7.2; least depth of caudal peduncle 4.1 to 4.6; length of pectoral fin 2.2 or 2.3; length of longest dorsal ray 1.8 to 2.1; length of longest anal ray 1.8 to 2.1; length of middle caudal rays 1.9; interorbital width 3.6 to 3.8; all in length of head. Angle of snout profile with axis of body 35 to 39 degrees, slightly convex.

Preocular groove shallow, short; orbital rim not prominent; interorbital elevated, very convex; plates behind branchial opening and above pectoral axil scarcely enlarged, only one larger than body scales, the rest smaller; area around mouth behind lips naked, wide groove extending posteriorly from rictus without scales; about 6 rows of scales on cheek narrow, elongated, imbedded, scarcely separated from each other by bare area and not as large as those of body; body scales on sides and belly also separated from each other by narrow bare strip of skin; 6 rows of short heavy antrorse spines on caudal peduncle, upper and lower rows with 1 to 5 spines per row, inner four rows with 7 to 11 spines per row; scales of rest of body without median enlarged tubercle; soft dorsal and anal fins high, elevated anteriorly; caudal fin truncate; teeth with smaller cusps scarcely developed so that teeth appear to be almost conical.

Color in alcohol.—Ground color of head and body pale greyish yellow to golden yellow, golden color more evident on middle of sides; upper lip and naked area behind lips black, black color extending from rictus posteriorly in and along sides of wide groove; lower lip and naked area behind it pale yellow, diffuse wide black band extending from orbit across postorbital part of head, including area around gill opening and pectoral base, spiny dorsal membrane brownish grey with black specks or blotches; soft dorsal and anal fins with narrow basal black band, broad median portion of fin pale orange or yellowish, broad marginal portion with rays black, membranes pale; pectoral fin similarly colored; caudal fin black basally and on upper and lower margins, median two-thirds of fin yellow, distal third black.

Genus PSEUDOBALISTES Bleeker

Pseudobalistes Bleeker, Nederl. Tijdschr. Dierk., vol. 3, p. 11, 1866 (type species, *Balistes flavimarginatus* Rüppell).

PSEUDOBALISTES FUSCUS (Bloch and Schneider)

PLATE 141,A

Balistes fuscus BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 471, 1801 (based on "le Baliste grande" of Lacepède, Histoire naturelle des poissons, vol. 1, p. 378, 1798; type locality, not given).

SPECIMEN STUDIED

Rongelap Atoll: Rongelap Island, lagoon side, spear at 10 to 20 feet, July 21, S–46–389, Brock, 1 specimen, 174.5 mm.

Description.—Dorsal fin rays III–ii,24; anal rays ii,20; pectoral rays i,13; branched caudal rays 5+5; gill rakers on first arch 34; scale rows 45; teeth in upper jaw 8, lower jaw 8.

Depth of body 1.7; length of head 2.7; both in standard length. Snout 1.3; diameter of eye 4.6; least depth of caudal peduncle 3.55; length of pectoral fin 2.0; length of longest dorsal fin ray 1.4; length of longest anal fin ray 1.5; length of upper caudal ray 1.5; of middle caudal ray 1.0; of lower caudal ray 1.1; interorbital width 3.6; all in length of head. Angle of snout profile with axis of body 40 degrees, snout profile convex.

Preocular groove present; interobital rounded; enlarged plates behind gill opening; area around mouth naked, 4 rows of scales on cheeks reduced to small tubercles, anterior part of cheeks and space between tubercles naked; caudal peduncle not armed, its scales not modified; soft dorsal and anal fins elevated anteriorly, caudal fin rounded in middle, its upper and lower rays elongated.

Color in alcohol.—Ground color of head pale yellowish brown, scales grey, interorbital area with short wavy transverse lines, indistinct short lines, some broken into spots radiating from eye; short irregular wavy lines on nape; irregular vertical disconnected lines on opercle, some curving onto breast, indistinct on ventral portion; body and vertical fins with a fine regular brown network outlining scales, center of each scale with small round yellowish white spot; spiny dorsal fin membrane dark brown, darker along distal margin; soft dorsal with yellow spots joined together at base to form narrow lengthwise light band; median portion of fin reticulated, spots fading distally, first 6 rays dark to tips, posterior to tips of rays white forming a narrow white marginal band; anal fin similarly colored except submarginal light and dark bands present with margin white; pectoral fin uniformly grey on base, basal two-thirds of rays light grey, distal third white; caudal fin spotted over basal three-fourths, upper and lower rays uniform brownish grey to tips, middle rays with broad white margin and narrow black submarginal band.

Genus MELICHTHYS Swainson

Melichthys Swainson, Natural history and classification of fishes . . ., vol. 2, pp. 194, 325, 1839 (type species, *Balistes ringens* Osbeck 1765=*B. ringens* Bloch=*B. radula* Solander 1848 (not *ringens* Linnaeus 1758)).

MELICHTHYS VIDUA (Solander)

Balistes vidua Solander, *in* Richardson, Zoology of the voyage of the *Sulphur*, Fishes, p. 128, pl. 59, figs. 9, 10, 1844 (type locality, Tahiti).

SPECIMENS STUDIED

Arno Atoll: Ocean reef, Strasburg, 1950.
Kwajalein Atoll: In the lagoon, Randall, 1951, 155 mm.

Description.—Dorsal II–ii,33; anal ii,28; i,13–i,13; branched caudal 5+5; scales 67; gill rakers on first gill arch 30; teeth 8+8.

Depth 2.0; head 3.2; both in standard length. Snout 1.3; eye 4.9; least depth of caudal peduncle 3.7; length of pectoral fin 2.8; longest dorsal ray 1.5; longest anal ray 1.7; length of upper caudal ray 1.6; length of lower caudal ray 1.9; interorbital space 2.7; all in length of head.

Color when alive.—Recorded from a kodachrome picture taken by John Randall: Body and head dark blue; dorsal and anal fins light blue, with distal margins bordered by narrow black band; posterior half of caudal fin reddish, basal half white.

Genus BALISTAPUS Tilesius

Balistapus Tilesius, Mem. Acad. Sci. St. Petersbourg, vol. 7, p. 306, 1820 (emended to *Balistopus* Agassiz, Nomenclatoris zoologici index, 1846; (type species, *Balistapus capistratus* Tilesius=*Balistes undulatus* Mungo Park).

BALISTAPUS UNDULATUS (Mungo Park)

Plate 140,A

Balistes undulatus Mungo Park, Trans. Linn. Soc. London, vol. 3, p. 37, 1797 (type locality, Sumatra).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 7 specimens, 111 to 183 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 128 mm.
Rongelap Atoll: 2 stations, 2 specimens, 81 to 91 mm.
Guam: 2 lots, 2 specimens, 78 to 127 mm.

Description.—Dorsal fin rays III–ii,23 or 24; anal rays i,22 or 23; pectoral rays i,12; branched caudal rays 5+5; gill rakers on first arch 36 to 40 (in 2 counts), long, slender, pointed, about 4.0 in eye; scale rows 43 to 46; teeth in upper jaw 8, lower jaw 8.

Depth of body 1.7 to 2.1; length of head 2.6 to 2.9; both in standard length. Snout 1.2 to 1.4; diameter of eye 4.3 to 6.5; least depth of caudal peduncle 2.8 to 3.0; length of pectoral fin 2.5 to 2.7; length of longest soft dorsal ray 2.8 to 3.9; length of longest anal ray 3.0 to

3.4; length of middle caudal fin rays 1.7 to 1.9; interorbital width 4.2 to 4.5; all in length of head. Angle of snout profile 36 to 38 degrees, snout profile slightly concave.

Teeth large, white, notched; no deep groove before eye below nostril; interorbital convex, rounded; third dorsal spine well developed, at least half of it projecting above rim of groove; caudal peduncle armed with two rows of strong recurved spines, 3 or 4 spines per row; caudal peduncle scarcely constricted; hind margin of pectoral fin rounded; soft dorsal and anal fin low, slightly rounded; hind margin of caudal fin slightly rounded, subtruncate.

Color in alcohol.—Ground color of head and body light greyish brown to dark brownish black; lips dark brown, the lower with a transverse light line; light line across chin running posteriorly along lower cheek and joining a fainter light line coming from anterior part of snout just behind lips; thin light line crossing snout running obliquely backward and downward across cheek; light lines curving around base of soft dorsal in widening concentric curves covering entire side; caudal peduncle spines black, the area around these spines jet black; spiny dorsal membrane with a round intensely black dot on distal portion between first and second spines, rest of membrane dusky brown; soft dorsal and anal fins pale with the bases of rays brown; caudal fin rays dusky, outer unbranched rays with black margin, membranes pale; pectoral fin pale yellow.

Color in life.—Ground color dark purplish brown; brick red bar on lower lip; 3 red lines extending posteriorly from chin and snout (just behind mouth), joining and curving downward below pectoral fin where they fade, these lines narrowly margined with black and separated by narrow dark blue lines; spiny dorsal membrane brown with black spot in anterior distal portion between first and second spines; soft dorsal and anal pale orange red on basal four-fifths, margin pale, color stronger on rays than membranes; pectoral fin rays reddish, membranes hyaline; caudal fin base with 3 indistinct narrow vertical red lines separated by narrow black-bordered blue lines; caudal fin rays reddish brown basally, each ray with a black border, membranes and distal third of each ray bright yellow.

Genus RHINECANTHUS Swainson

Rhinecanthus Swainson, Natural history and classification of fishes . . ., vol. 2, pp. 194, 325, 1839 (type species, *Balistes aculeatus* Linnaeus).

RHINECANTHUS RECTANGULUS (Bloch and Schneider)

Plate 140,C

Batistes rectangulus Bloch and Schneider, Systema ichthyologiae . . ., p. 465, 1801 (based on "le Baliste echarpe" of Lacepède, Histoire naturelle des poissons, vol. 1, pp. 333, 352, pl. 16, fig. 1, 1798; type locality, Indian Ocean).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 45 specimens, 43 to 172 mm. in standard length.
Eniwetok Atoll: 4 stations, 8 specimens, 90 to 157 mm.
Rongelap Atoll: 1 station, 1 specimen, 121 mm.
Rongerik Atoll: 2 stations, 6 specimens, 96 to 135 mm.
Kwajalein Atoll: 1 station, 6 specimens, 54 to 155 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 144 mm.
Rota Island: 1 lot, 1 specimen, 152 mm.

Description.—Dorsal fin rays III–ii,21 or 22; anal i,20; pectoral rays i,12; branched caudal rays 5+5; gill rakers on first arch long, slender, pointed 23 or 24 (in 3 counts); teeth, upper jaw 8, lower jaw 8; scale rows from upper edge of gill opening to base of middle caudal rays 39 to 43.

Depth of body 1.9 to 2.3; length of head 2.3 to 2.5; both in standard length. Snout 1.2 to 1.5; diameter of eye 4.2 to 6.6; least depth of caudal peduncle 4.0 to 5.1; length of pectoral fin 2.5 to 3.4; length of longest soft dorsal ray 2.5 to 2.9; length of longest anal ray 2.8 to 3.2; length of middle caudal rays 1.9 to 2.5; interorbital width 4.1 to 4.7; all in length of head. Angle of snout profile 29 to 35 degrees, snout profile usually straight, sometimes slightly concave or convex.

Teeth large, white, deeply notched; no deep groove before eye below nostril; interorbital slightly convex; third dorsal spine small, not projecting above rim of groove; caudal peduncle armed with 3 or 4 rows (usually 4) of antrorse spines, 4 or 5 teeth in dorsal row, 8 to 10 in two middle rows, ventral row 0 to 8 teeth; caudal peduncle constricted; hind margin of caudal fin rounded in young, truncate in adults.

Color in alcohol.—Ground color of head and body pale yellowish white; lips pale, white or yellow, faint bluish grey line just behind lips around dorsal portion of mouth, not extending onto chin; interorbital area usually dark grey (sometimes black) with 3 darker transverse lines; dark band, slightly narrower than eye, extending from lower edge of orbit, broadening ventrally to include base of pectoral and extending posteroventrally to anterior two-thirds of anal base; upper margin of this black diagonal body band pale; a light grey (sometimes brown) line running from middle third of body band to posterior dorsal base; area around anus black; broad black band around caudal peduncle, lateral portion of this band extending forward, including caudal peduncle spines and forming a triangular shaped patch, the anterior margin of which usually has a broad light silvery line; dorsal fin spines pale, membranes brown or black; soft dorsal pale, translucent; caudal fin light dusky; pectoral fin base black, rest of fin pale.

Color in life.—Pattern as described for preserved specimen; ground color of back light greyish brown; blue line around dorsal portion of

mouth, just behind lips; broad blue line extending from anterior portion of dark interorbital patch, anterior to eye, downward, curving posteriorly toward ventral part of pectoral base; margins of black triangular caudal peduncle patch bright yellow; upper margin of posterior half of black diagonal body band and line extending to posterior dorsal base bright golden yellow; pectoral fin with bright red transverse band just distal to black base.

RHINECANTHUS ACULEATUS (Linnaeus)

PLATE 140,B

Balistes aculeatus LINNAEUS, Systema naturae, ed. 10, p. 328, 1758 (type locality, India).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 18 specimens, 106 to 175 mm. in standard length.
Eniwetok Atoll: 1 specimen, 145 mm.
Rongerik Atoll: 2 stations, 5 specimens, 25 to 161 mm.
Guam: 10 lots, 32 specimens, 29 to 160 mm.
Rota Island: 2 lots, 2 specimens, 136 and 155 mm.

Description.—Dorsal fin rays III–ii,23 or 24; anal rays i,21 or 22; pectoral rays i,12 or 13; branched caudal rays 5+5; gill rakers on first arch 21 to 25 long, slender, pointed about 2.7 to 3.0 in eye; scale rows 41 or 42; teeth in upper jaw 8, lower jaw 8.

Depth of body 1.7 to 2.4; length of head 2.2 to 2.5; both in standard length. Snout 1.2 to 1.7; diameter of eye 3.1 to 7.5; least depth of caudal peduncle 4.3 to 5.3; length of pectoral fin 2.2 to 3.3; length of longest soft dorsal ray 2.7 to 3.3; length of longest anal ray 2.7 to 3.7; length of middle caudal fin rays 1.5 to 2.4; interorbital width 3.3 to 4.7; all in length of head. Angle of snout profile 28 to 37 degrees, snout profile almost straight, sometimes slightly concave or convex.

Teeth large, white, deeply notched; no deep groove before eye below nostril; interorbital smoothly convex; third dorsal spine not projecting above rim of groove; caudal peduncle armed with 3 rows of spines, 2 upper rows with 10 to 12 spines each of about equal length, lower row with 3 to 5 spines, a third to half length of upper; caudal peduncle constricted; caudal fin rounded in young, subtruncate in adults.

Color in alcohol.—Ground color of upper parts light greyish brown, of under parts pale yellowish white; lips light brown or yellowish, a faint bluish white line around mouth just behind lips (usually absent on chin); interorbital area dark grey with 2 to 4 darker lines crossing interorbital space; narrow white or greyish line running from anterior part of eye downward and curving in to lower edge of pectoral insertion; a dark band, slightly narrower than eye, sometimes white

bordered, running downward from lower orbital rim along anterior margin of opercular opening and pectoral base; middle of side with large black patch, broad band extending from this patch to anterior part of dorsal base, broad line extending ventrally from black patch to anus, then a narrow line not as long extending posteriorly to first line, then a second broad black line reaching almost to middle third of anal fin base, then a short narrow black line becoming pale yellowish; posteriorly the black patch widens, dorsal part reaching posterior part of dorsal fin, ventral part extending toward caudal peduncle; caudal peduncle spines jet black; spiny dorsal membrane greyish black; soft dorsal pale, anal fin pale yellow; caudal fin dusky, its dorsal and ventral margins darker, distal margin pale; pectoral fin pale yellow, transluscent.

Color in life.—Pattern as described in preserved specimen; lips and anterior part of snout bright yellow, the yellow extending posteriorly along cheek in tapering band ending just below and posterior to pectoral fin insertion; top of snout, head, and back light greyish brown; blue line over top of snout just behind lips; 4 blue lines running from eye across interorbital to join fellows, blue line curving downward to lower edge of pectoral insertion, black subocular band bordered with blue lines, lower sides white; area around anal opening black; area around caudal spines white; dorsal, anal, and caudal fins yellow with faint orange color on basal half; pectoral fin yellow; black patch and markings on sides as described in preserved specimen.

Family OSTRACIONTIDAE

By Loren P. Woods

Genus OSTRACION Linnaeus

Ostracion Linnaeus, Systema Naturae, ed. 10, p. 330, 1758 (type species, *Ostracion cubicus* Linnaeus).

KEY TO THE SPECIES OF OSTRACION AND LACTORIA FROM THE MARSHALL ISLANDS

1*a*. Carapace smooth, without spines.

2*a*. Body pale yellowish brown to dark bluish brown; back with black or dark-bordered white spots, one in the middle of each scute (young with large round black dots scattered, not in center of each scute); sides and belly plain or with a few scattered small brown dots or dark-ringed white spots; dorsal and caudal fins with round brown dots or plain; gill rakers on first arch 12 to 15. **Ostracion cubicus** Linnaeus

2*b*. Body dark brown to dark bluish gray; back and sides with close-set small white dots. Males with immaculate convex snout; white spots on sides either larger than those on back or absent. Females with evenly spaced white spots on concave snout, back, sides, and belly. Caudal peduncle and base of caudal fin of both sexes white spotted; gill rakers on first arch 9 to 11 **Ostracion meleagris** Shaw

1*b*. Carapace with prominent spines **Lactoria fornasina** (Bianconi)

OSTRACION CUBICUS Linnaeus

PLATES 136,B; 144,A

Ostracion cubicus LINNAEUS, Systema naturae, ed. 10, p. 332, 1758 (type locality, India).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 41 and 42 mm. in standard length.
Eniwetok Atoll: 2 stations, 2 specimens, 13 to 138 mm.
Rongelap Atoll: 4 stations, 6 specimens, 27 to 247 mm.
Rongerik Atoll: 1 station, 1 specimen, 108 mm.
Northern Marshall Islands: 1 specimen, 179 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 23 mm.

Description.—Dorsal rays i,8; anal i,8; pectoral rays i,9 or 10; branched caudal rays 4+4; teeth, upper jaw 6 to 10, lower jaw 7 to 10; gill rakers on first arch 12 to 15.

Depth of body 2.2 to 3.3; width across dorsal surface 2.4 to 3.6; across ventral surface 2.0 to 3.2; head 2.9 to 4.1; all in standard length. Snout 1.3 to 1.5; eye 2.6 to 3.4; least depth of caudal peduncle 2.3 to 3.4; length of pectoral fin 1.4 to 1.6; postorbital part of head 3.9 to 4.8; interorbital 1.0 to 1.3; all in length of head. Angle of snout profile 40 to 48 degrees, snout convex in males, concave in females.

Body very short, almost round in young (13 mm.), blunt anteriorly, tapered posteriorly, growing more slender and elongate with age; back smoothly rounded, sides concave, belly concave; a short protuberance on anterior tip of armor above mouth, scarcely evident in young, most developed in old males; a large fleshy bump on chin, more pronounced on large specimens; anal fin originates posteriorly to insertion of last dorsal ray; lower edge of gill opening directly below hind margin of eye; young specimens (up to 41 mm.) with slight dorsal ridge with 2 or 3 tubercles evident, lateral and pelvic ridges with 3 or 4 tubercles just back of middle.

Color in alcohol.—Ground color pale yellowish brown to dark bluish brown; back with pale-centered spots in the middle of each scute, pale center blue, white, or absent; in dark-colored specimens spots may be obscured, only a few small dots being evident; sides of large specimens completely plain or with a few scattered dark spots, breast plain or with small dots, 1 or 2 on each scute; belly immaculate; scutes of cheek outlined with yellow or white in some specimens, in others, color of membranes between the scutes same as ground color; dorsal fin dark basally, spotted or plain, distal half to third pale or with dark margin; anal fin pale or dark basally, colored on rays, membranes pale, distal third pale; caudal fin spotted or plain, spotted basally or entirely, caudal pale dusky or very dark.

Young. Ground color yellow; large round brown or black dots,

some smaller, some larger, than pupil, scattered over head and body; a ring of small dots around eye; 2 or 3 dots on each side of caudal peduncle; fins all pale white, yellowish, or transparent. The spots proportionately less numerous and smaller as specimens increase in size.

Remarks.—After carefully examining about 50 specimens of this species of various sizes from many parts of the Pacific and Indian oceans, we have concluded that the colors and patterns, in alcohol at least, are exceedingly variable as may be noted in the color descriptions above. Therefore, we have combined all of the specimens, even though they deviate from the normal pattern, under one name. In so doing we have undoubtedly included several nominal species.

OSTRACION MELEAGRIS Shaw

PLATE 141,C,D

Ostracion meleagris SHAW, *in* Shaw and Nodder, Naturalist's miscellany, vol. 7, pl. 253, 1796 (type locality, Southern Ocean).

Ostracion lentiginosus BLOCH and SCHNEIDER, System ichthyologiae . . ., p. 501, 1801 (type locality, India, about Francis Island).

Ostracion sebae BLEEKER,[28] Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 259, 1851.

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 3 specimens, 32 to 40 mm. in standard length.
Eniwetok Atoll: 3 stations, 5 specimens, 37 to 115 mm.
Rongelap Atoll: 2 stations, 2 specimens, 111 to 134 mm.

Description.—Dorsal rays i,6 to i,8; anal i,7 or 8; pectoral rays ii,9; branched caudal rays 4+4; teeth upper jaw 10 to 12, lower jaw 9 to 11. Gill rakers on first arch 9 to 11.

Depth of body 2.2 to 3.2; width across dorsal surface 2.2 to 3.1; across ventral surface 1.9 to 2.9; head 2.8 to 3.8; all in standard length. Snout 1.2 to 1.5; eye 2.5 to 3.3; least depth of caudal peduncle 2.8 to 4.0; length of pectoral fin 1.5 to 1.7; postorbital part of head 4.0 to 5.2; interorbital 1.05 to 1.2; all in length of head. Angle of snout profile with lengthwise axis of body 45 degrees in females, concave, 50 degrees in males, convex.

Body very short, almost square in young (40 mm.) growing more elongate with age; ventral ridge more developed in adult females than in males; anal fin originates under fifth or sixth branched dorsal ray; first pectoral fin ray very short, tuberculate; gill opening not extending forward beyond hind margin of eye; in young, gill opening connecting with a groove that runs along base of pectoral fin; in very young, median dorsal ridge evident, lateral and pelvic ridges tubercu-

[28] According to Fraser-Brunner (Ann. Mag. Nat. Hist., ser. 11, vol. 6, pp. 391-392, 1940) *O. sebae* Bleeker is the male of *O. lentiginosus* Bloch and Schneider, which is the female. The specimens examined by us verified that observation.

late; in adults, back smoothly rounded, lateral and pelvic ridges smooth; adults with deep groove anteriorly and ventrally outlining cheek, ventral groove especially evident in males.

Color in alcohol.—Males. Ground color brown to dark bluish grey; back spotted with evenly spaced small white dots, smaller than pupil; an irregular white line across forehead; snout dark brown to greyish brown; cheeks pale, yellowish or greyish white, sometimes with indistinct large brown spots; sides of body with white spots almost as large as pupil, often elongate; breast and belly dark brown to dark greyish brown, breast usually darker than belly; under surface without spots except for three or four white dots near sides just behind position of pectorals and from anus posteriorly to end of armor; caudal peduncle and base of caudal fin dark with large white spots, the uppermost usually elongate, often forming a wavy white lengthwise line; bases of dorsal, anal, and pectoral fins dark brown to black, rays of these fins dusky, the membranes pale; dorsal fin sometimes with indistinct small dark dots; caudal fin dark brown basally, distal half with broad crescentic area white or hyaline. Colors and patterns of males quite variable, the white spots sometimes entirely absent from sides, breast, belly, lower part of caudal peduncle, and base of caudal.

Females. Ground color dark, bluish grey. Head, back, sides, belly, caudal peduncle, and base of caudal fin evenly spotted with small white spots, smaller than pupil; white spots indistinct on cheeks and anterior portion of ventral side of armor; spots on sides and belly slightly larger than those on back often running together to form narrow, short, wavy lines; white spots on caudal peduncle round, not elongate; bases of pectoral, anal, and dorsal dark, sometimes dotted with white, rays dusky, membranes pale; basal two-thirds of caudal fin dark bluish grey with white spots, distal one-third white.

Genus LACTORIA Jordan and Fowler

Lactoria Jordan and Fowler, Proc. U.S. Nat. Mus., vol. 25, p. 278, 1903 (type species, *Ostracion cornutus* Linnaeus).

LACTORIA FORNASINA (Bianconi)

Plate 141,B

Ostracion fornasini Bianconi, Nuovi Ann. Sci. Nat. Bologna, ser. 2, vol. 5, p. 115, 1846 (type locality, Mozambique; ref. copied).

Ostracion (*Acanthostracion*) *fornasini* Bleeker, Atlas ichthyologique . . ., vol. 5, pl. 203, fig. 4, 1865 (Amboina).

Lactoria galeodon Jenkins, Bull. U.S. Fish Comm., vol. 22 (1902), p. 487, fig. 34, 1903 (Honolulu; holotype USNM 50717).

SPECIMEN STUDIED

Bikini Atoll: Bikini lagoon, 2 miles inside Enyu Channel, picked up dead, floating, July 27, 1946, Welander, 1 specimen, 86 mm.

Description.— Dorsal rays i,7,i; anal i,8; pectoral rays x; branched caudal rays i,4+4,i; teeth (some lost?), upper jaw 7, lower jaw 3.

Depth of body, excluding dorsal spine and measured at pectoral region, 2.5 (35.1 mm.); depth of body including dorsal spine and measured at that point 2.2 (38.7 mm.); width across dorsal surface 3.4 (25.4 mm.); across ventral surface 2.1 (41.2 mm.); head (tip of snout to upper edge of gill opening) 3.3 (26.0 mm.); snout to anus 1.3 (63.8 mm.); all in standard length. Snout 1.4 (18.8 mm.); eye 2.5 (10.4 mm.); interorbital 3.2 (8.2 mm.); least depth of caudal peduncle 3.3 (8.0 mm.); length of pectoral fin 1.5 (17.0 mm.); length of caudal fin 1.2 (21.9 mm.); height of dorsal fin 1.8 (14.7 mm.); height of anal fin 2.0 (12.8 mm.), gill opening 5.8 (4.5 mm.); postorbital part of head 6.8 (3.8 mm.); dorsal spine (carapace spines all measured to base where ridges of spine are longest before definitely breaking up into rows of papillae around base) 1.7 (14.9 mm.); ocular spines 3.0 to 3.1 (8.8 and 8.3 mm.); anal spines 2.3 (11.4 mm.); all in length of head. Angle of snout profile 47 degrees, snout first convex, then concave, and then convex.

Body pentagonal in cross section, covered by a carapace formed by firmly united mostly hexagonal plates; carapace with 5 prominent spines, one above each eye pointing directly forward, one on dorsal ridge midway between dorsal fin and eye curving posteriorly, one on each side of anal fin terminating the ventrolateral ridges and pointing directly posterior; dorsolateral ridge bluntly pointed below dorsal spine; gill openings vertical, ventral corner about level with base of second pectoral ray; caudal peduncle with least depth near carapace, increasing gradually in depth to base of caudal without free plates; edges of all fins convex, caudal almost truncate, dorsal and anal tending toward falciform, pectoral falciform with anterior ray longest and posterior ray less than half length of anterior ray; carapace closed behind dorsal fin, all fins rising from separate, skin covered openings; carapace covered by numerous close-set minute papillaelike structures that are largest ventrally and under chin, and absent on spines; spines with fine ridges converging toward tips; ventral surface of carapace more or less flat, convex anteriorly, concave posteriorly; all other surfaces concave, interorbital space concave; scales of sides more, or less hexagonal, 8 or 9 in longitudinal series from gill opening to tail, 11 in median line of ventral surface (mouth to anus), 5 from between ventrolateral and to dorsolateral ridges counting obliquely from blunt point of dorsolateral ridge.

Color in alcohol.—Sides and back with ground color light brown covered with irregular dark brown to black spots and stripes of varying length and pattern, some following the edges of scales, others across scales; large spot behind dorsal fin enclosed parenthetically by

V-shaped stripes; ground color between, and above eyes darker; cheeks and snout with obscure markings similar to sides but with fewer lines and more spots; ground color of ventral surface pale brown or yellow with numerous indistinct spots disappearing anteriorly; caudal peduncle with scattered round or oblong spots; caudal fin with 6 dark vertical bars separated by 7 pale bars of same width; dorsal fin with white bar on fin rays across and just above base; other fins without color or pale.

Remarks.—One specimen about 18 mm. long was taken from the stomach of an *Elagatis bipinnulatus*, collected on July 23, 1947, by J. C. Marr. This tiny specimen (USNM 140645) had been crushed, somewhat distorted laterally, and its fins dissolved away so that a positive identification is difficult. Carapace closed behind anal fin; no evident preocular spines; pelvic spines present and 2 smaller spines anterior to pelvic spine on pelvic ridge; no mid-ventral ridge; left lateral ridge with one spine about the middle of body; a larger spine present in the middle of the back, which may be a displaced spine from right lateral ridge; ventral side of body much broader than dorsal side. The genus that most nearly fits this description is *Lactoria*, but because of the questionable position of the middorsal spine and the lack of preocular spines, we can only tentatively assign this specimen to that genus.

Suborder TETRAODONTINA

Family CANTHIGASTERIDAE

By LOREN P. WOODS

Genus CANTHIGASTER Swainson

Canthigaster SWAINSON, Natural history and classification of fishes . . ., vol. 2, p. 194, 1839 (type species, *Tetraodon rostratus* Bloch, pl. 146; name used on p. 328 by Swainson is *Psilonotus*).

KEY TO SPECIES OF CANTHIGASTER FROM THE NORTHERN MARSHALL ISLANDS AND ADJOINING REGIONS

1*a*. Dorsal rays i,11; anal rays, i,10.

2*a*. Top of snout crossed by 3 or 4 black saddlelike lines; eye with its posterior radiating lines arcing dorsally but not joining with those of opposite side; cheeks with parallel rows of small close-set black dots anteriorly forming lines curving downwards toward throat; back and sides with small round pale spots, each with a minute black dot in its center; additional dark spots present on lower sides, especially prominent between base of pectoral fin and vent (these spots larger and more intense in young); pectoral, dorsal, and anal fins black along base and on tips of first (and sometimes second) rays, rest of fin white.

C. amboinensis (Bleeker)

1*b*. Dorsal rays i,8 or 9; anal rays i,8 (rarely i,7).

3*a*. Dorsal rays i,8.

4*a*. Caudal fin with dark-bordered light spots arranged in slightly irregular tranverse bars; head and body with small evenly spaced dark-bordered light spots, some with dark centers; spots along lower cheeks ending ventrally in a clean even line along chin and throat; dark, ocellated spot usually present at base of dorsal. **C. solandri** (Richardson)

4*b*. Caudal fin without spots; rays dusky yellowish, membranes pale or dusky; head and body with round pale spots, none with borders darker than ground color; ground color forming a network of lines on lower sides, this network disappearing anteroventrally.

5*a*. Dark ocellate spot present just below base of dorsal fin, sometimes a light dot or dash present in center of dark spot; pale streaks crossing snout in front of eye---**C. janthinopterus** [29] (Bleeker)

5*b*. No single ocellate spot just below base of dorsal fin; instead, irregularly shaped white spots like those on back and sides; pale streaks if present not crossing snout and meeting their fellows on mid-dorsal line; snout usually with dusky spots, probably blue when alive----------**C. jactator** (Jenkins)

3*b*. Dorsal rays i,9; back and upper sides of body brown, lower sides and belly abruptly pale yellowish brown; head, back, and sides with numerous tiny pale spots; dark brown oblong spot at base of dorsal fin outlined by broken oblong blue spots; upper part of caudal peduncle with two indistinct dark bars (sometimes broken) meeting on middorsal surface of caudal peduncle, the points of these bars directed posteriorly; eye with radiating blue lines, none meeting those from opposite side over snout or interorbital; 2 or 3 broken vertical lines on cheek just posterior to corner of mouth; a narrow blue mid-ventral line extending from chin to vent; caudal fin rays yellowish; membranes hyaline----------**C. bennetti** (Bleeker)

CANTHIGASTER AMBOINENSUS (Bleeker)

PLATE 142,D

Psilonotus amboinensis BLEEKER, Nederl.-Tijdschr. Dierk., vol. 2, p. 180, 1865 (type locality, Amboina).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 54 to 61 mm. in standard length.
Eniwetok Atoll: 2 stations, 6 specimens, 75 to 86 mm.
Guam: 2 lots, 4 specimens, 22 to 50 mm.

Description.—Dorsal rays i,11; anal i,10; pectoral rays ii,15; branched caudal rays 3+4; gill rakers 8 to 10 (usually 9) on anterior side of first gill arch.

Depth of body 1.9 to 2.2; width of body at pectorals 3.0 to 4.2; length of head 2.4 to 2.7; length of caudal fin 3.1 to 3.6; all in standard length. Snout 1.4 to 1.6; diameter of eye 3.3 to 4.9; least depth of

[29] We identify as this species one of the specimens from Rose Island (USNM 115295), reported on by Schultz (U.S. Nat. Mus. Bull. 180, p. 295, 1943) as *C. solandri*.

caudal peduncle 2.0 to 2.5; length of pectoral fin 1.8 to 2.2; height of dorsal fin 1.9 to 2.3; height of anal fin 2.2 to 3.4; postorbital part of head (upper edge of gill opening to margin of eye) 3.6 to 4.0; interorbital width 2.9 to 4.6; all in length of head. Angle of snout profile with axis of body 39 to 48 degrees, snout straight in small specimen (36.5 mm.), concave in female of 65 mm., convex in 84 mm. male.

Back slightly keeled; belly of some large male specimens with raised median fleshy ridge, belly of females smoothly rounded; small spines present on entire head except sides of caudal peduncle, sometimes spines absent from dorsal and ventral surfaces of caudal peduncle; hind margin of caudal fin nearly straight, only slightly convex; first unbranched pectoral ray very short, less than one-third height of second; anal fin origin posterior to insertion of last dorsal ray.

Color in alcohol.—Ground color of head and body light greyish-brown to almost black; top of snout crossed by 3 to 4 black saddle lines; eye with about 9 thin white-bordered radiating lines, those on anterior and upper border crossing over to meet their fellows, those on posterior border arcing dorsally but not meeting fellows; cheeks with small close-set black dots which form parallel rows anteriorly and pass downward toward throat; back and sides with small round pale spots each with a minute black dot in its center; additional dark spots present on lower sides, especially prominent between pectoral and anal fins; belly lighter than body and with a median dark line extending from vent forward and fading on breast or throat; pectoral fin black along base and tip of first and sometimes second rays, rest of fin white; dorsal and anal fins similarly colored; caudal fin dusky grey to black, the small black-centered pale dots extending onto the base of fin and sometimes almost to tip.

Young (22 mm.) pale grey on head and body; tip of snout dusky, no parallel downward curving lines on anterior part of cheeks; no radiating lines from anterior, dorsal, or ventral parts of eye, radiating lines from posterior part of eye curving dorsally as in adult; lower anterior sides of body with network of intense black lines; back and upper sides with indistinct pale round spots lacking dark centers; dark spot present at base of dorsal fin; pectoral, dorsal, and anal fins colorless; caudal fin dusky with narrow pale distal margin.

CANTHIGASTER SOLANDRI (Richardson)

PLATE 144,B

Tetrodon solandri RICHARDSON, Zoology of the voyage of H.M.S. *Sulphur*, Fishes, p. 125, pl. 57, figs. 4–6, 1845 (type locality, Polynesia).

Canthigaster saipanensis FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 79 p. 73, fig. 18, 1945 (types ANSP 71607 and 71608 examined by Schultz; type locality, Saipan).

SPECIMENS STUDIED

Bikini Atoll: 18 stations, 59 specimens, 14 to 68 mm. in standard length.
Eniwetok Atoll: 6 stations, 46 specimens, 13 to 71 mm.
Rongelap Atoll: 8 stations, 44 specimens, 23 to 59 mm.
Rongerik Atoll: 3 stations, 10 specimens, 26 to 69 mm.
Guam: 9 lots, 20 specimens, 17 to 78 mm.
Saipan: 1 lot, 2 specimens, 65 to 69 mm.

Description.—Dorsal rays i,8; anal i,8 occasionally i,7; pectoral rays ii,13 to 15, usually ii,14; branched caudal rays 4+3; gill rakers on first arch 8.

Depth 2.2 to 2.4; width of body at pectoral insertion 3.5 to 4.1; head 2.4 to 2.7; all in standard length. Snout 1.4 to 1.6; diameter of eye 3.6 to 4.5; least depth of caudal peduncle 1.7 to 2.3; length of pectoral fin 2.4 to 2.9; height of dorsal fin 2.1 to 2.6; height of anal 2.3 to 3.2; postorbital part of head (upper edge of gill opening to margin of eye) 4.0 to 4.4; interorbital width 3.1 to 3.8; all in length of head. Angle of snout profile with axis of body 42 to 43 degrees, snout concave in small specimens, straight in largest males (78 mm.).

Back smoothly rounded in some specimens, keeled to strongly keeled in others; a fleshy median ridge often present on belly extending forward either a short distance or to chin; interorbital concave; small spines present in skin, thickly distributed over head and body except naked areas around mouth, bases of fins, and a small area on posterior side of caudal peduncle; first pectoral ray about half height of second, hind margin of caudal fin slightly convex; dorsal fin origin posterior to insertion of last dorsal ray.

Color in alchool.—Color and pattern somewhat variable; in most specimens ground color of head, back, and sides light reddish brown to dark greyish brown; round white bluish spots smaller than pupil, usually with narrow dark border, evenly distributed over entire head, body, and caudal fin; sometimes spots on cheek with dark centers; 2 or 3 light spots just behind corner of mouth forming short lengthwise bars, but in none of our specimens do these short bars extend as far back as eye; spots along lower cheek ending ventrally in a clean even line along chin and throat; lips, chin, throat, and belly light yellowish white to greyish white; belly streaked with thin dark lines just anterior to vent, these lines sometimes broken into dark spots, sometimes absent, not extending anterior to throat; 9 to 12 short radiating dark brown or blue lines around eye, anterior and dorsal lines extending onto dorsal part of snout or interorbital, sometimes meeting its fellow, sometimes breaking into one or two dark spots; lines radiating from posterior part of eye usually very short, but longer on one or two small specimens and extending toward dorsal fin base or meeting their fellows across back; a dark spot, sometimes ocellated, at base of dorsal fin, sometimes scarcely evident; if ocellated, the light

line is rarely entire, being broken into curved oblong spots; pectoral, dorsal, and anal fins pale, translucent; caudal fin spotted with usually dark-bordered light spots arranged in vertical rows, sometimes these spots elongated vertically to form 5 to 7 broken vertical bars on caudal, this vertical arrangement more distinct distally.

Color in life.—Pattern as described in preserved specimens; ground color of head bright golden yellow or purplish, that of back and sides purplish brown; radiating lines about eye and on body light blue; chin and throat bright golden yellow, sometimes a faint yellowish tinge extending posteriorly on belly; distal half to two-thirds of caudal fin bright golden yellow; base of dorsal with a blue line transversely across rays, then a dark area at point of articulation of the fin, then a broader blue transverse line proximally to point of articulation; a very thin light blue line transversely across base of pectoral rays just distal to point of articulation of the rays; distal portions of dorsal, anal, and pectoral fins pale, sometimes dorsal with faint yellowish tinge.

CANTHIGASTER JACTATOR (Jenkins)

PLATE 142,C

Tropidichthys jactator JENKINS, Bull. U.S. Fish. Comm., vol. 19 (1899), p. 399, fig. 11, 1901 (type locality, Honolulu).

Canthigaster solandri SCHULTZ (in part), U.S. Nat. Mus. Bull. 180, p. 295, 1943 (Phoenix Islands; USNM 115294).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 52 mm. in standard length; 2 lots Univ. Washington, 2 specimens, 47 to 51 mm.

Eniwetok Atoll: 1 station, 1 specimen, 51 mm.

Description.—Dorsal rays i,8; anal i,8; pectoral rays ii,14 to 16; branched caudal rays 4+4; gill rakers 7 on anterior side of first gill arch (in 3 counts).

Depth of body 1.9 to 2.4; width of body at pectorals 2.7 to 3.6; length of head 2.2 to 2.4; length of caudal fin 2.8 to 3.5; all in standard length. Snout 1.5 to 1.6; diameter of eye 3.3 to 4.8; least depth of caudal peduncle 1.9 to 2.4; length of pectoral fin 2.1 to 2.8; height of dorsal fin 2.1 to 3.0; height of anal 2.2 to 3.4; postorbital part of head 4.3 to 5.4; interorbital width 2.7 to 4.1; all in length of head. Angle of snout profile with axis of body 34 to 39 degrees, snout slightly concave in small specimens (33 to 40 mm.), straight to slightly convex in larger ones (47 to 51 mm.).

Back with slight keel, belly smoothly rounded; interorbital concave; small spines present on back anterior to dorsal fin and on head and belly except naked areas around eye; sides of body and entire caudal

peduncle naked; hind margin of caudal fin straight to slightly convex; first unbranched pectoral ray less than half height of second; anal fin origin posterior to insertion of last dorsal ray.

Color in alcohol.—Color of head and body light brown to dark brown, arranged in a network with round or oval white spots in spaces; network of dark brown lines extending onto lower sides and forward along sides to below eye, network disappearing anteroventrally; light spots a little larger than size of pupil of eye, larger than dark spaces between except on back and upper sides; some light spots with dark centers, especially those of back and on dorsal part of head; snout, cheeks, and sometimes breast with small dark dots; two dark narrow parallel lines extending forward from anus on midline of belly to breast; eye with about 9 radiating dark lines, sometimes indistinct, none anterior to eye, crossing over top of snout or to mouth; lower and posterior radiating lines from eye merge into dark brown network; no dark ocellate spot at base of dorsal fin; dorsal, anal, and pectoral fins pale; caudal fin plain without spots, rays yellowish, membranes dusky or translucent.

Remarks.—*C. jactator* differs from *C. janthinopterus* in lacking the ocellate spot below base of dorsal fin and the streaks crossing dorsal surface of snout. These two species are represented by *C. punctatissimus* Günther in the American tropical Pacific.

CANTHIGASTER BENNETTI (Bleeker)

PLATE 142,B

Tropidichthys bennetti BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 6, p. 504, 1854 (type locality, Amboina).

SPECIMENS STUDIED

Marianas Islands: Guam Island, Apra Bay on reefs, Nov. 19–21, 1907, *Albatross*, 1 specimen, 65 mm.

Samoa Islands: Rose Island, reef, June 11–14, 1939, Schultz, 1 specimen, female, 50 mm. (USNM 115298).

Description.—Dorsal rays i,9; anal i,7 or i,8; pectoral rays ii,13; branched caudal rays 3+4; gill rakers 7 to 9 on anterior side of first gill arch (in 3 counts).

Greatest depth of body 2.5 to 2.7; width of body at pectorals 3.65 to 4.4; length of head 2.3 to 2.6; length of caudal fin 3.2 to 3.9; all in standard length. Snout 1.5 to 1.95; diameter of eye 3.5 to 4.3; least depth of caudal peduncle 2.7 to 3.3; length of pectoral fin 2.3 to 3.1; height of dorsal fin 2.2 to 2.8; height of anal fin 2.7 to 3.3; postorbital part of head 3.8 to 4.5; interorbital width 4.1 to 4.9; all in length of head. Angle of snout profile with axis of body 36 to 42 degrees, snout straight in small specimens (36 mm.), almost straight, slightly concave, in larger examples (50 and 65 mm.).

Back keeled in all specimens; belly of 50 and 65 mm. specimens with median fleshy ridge; interorbital concave; small spines present over entire head and body except naked areas around bases of fins, between hind margin of eye and axil of pectoral, and sometimes posteroventral portion of caudal peduncle; posterior margin of caudal fin convex; first unbranched pectoral ray less than half length of second; anal fin origin posterior to insertion of last dorsal ray.

Color in alcohol.—Ground color of top of head, back, and upper side light brown or greyish brown, with faint pale spots smaller than pupil; a darker brown blotch at base of dorsal fin outlined by broken blue oblong spots; top of caudal peduncle with two indistinct dark bars (sometimes broken) meeting on middorsal surface of caudal peduncle, points of bars directed posteriorly; lower cheeks, lower sides, and belly pale yellowish to white; line of demarkation between dark back and pale belly wavy color along this line darker; cheeks and sides of breast with closely set minute white dots; eye with 6 to 8 radiating blue or brown lines, some extending forward on snout curving downward posterior to mouth forming 2 or 3 vertical lines (these sometimes very indistinct); on largest specimen (65 mm.) a narrow blue mid-ventral line extending from chin to vent; pectoral, dorsal and anal fin colorless; caudal fin rays yellowish, membranes hyaline.

Remarks.—The four type specimens, 36 to 36.5 mm., of *C. constellatus* Kendall and Goldsborough (cotypes, USNM 65767) from the Paumotu Islands, Fakareva Atoll, although small, possess the same color pattern as the two larger specimens here listed and we believe them to be the same species.

CANTHIGASTER Sp.

Petraodon manillensis, Kendall and Goldsborough, Mem. Mus. Comp. Zool., vol. 26, no. 7, p. 335, 1911 (in part).

SPECIMEN STUDIED

Arno Atoll: Marshall Islands, Jan. 25–27, 1900, Field No. 09061, *Albatross*, 1 specimen, 14.5 mm. (USNM 66048).

Description.—Dorsal rays i,8; anal i,7; pectoral rays ii,16; branched caudal rays 3+4.

Depth of body 2.05; width at pectorals 2.8; length of head 1.95; length of middle caudal fin rays 2.7; all in standard length. Snout 2.2; diameter of eye 3.05; least depth of caudal peduncle 3.8; length of pectoral fin 2.7; postorbital part of head (upper edge of gill opening to margin of eye) 3.8; interorbital width 5.05; all in length of head. Snout concave.

Back rounded anteriorly, slightly keeled just anterior to dorsal fin, belly shrunken into many small lengthwise ridges; small scattered spines present on head and body.

Color in alcohol.—Ground color of head and body greyish green, back darker than sides and belly; 5 or 6 narrow lengthwise reddish lines present on sides, broken and irregular anteriorly, clearest on caudal peduncle; skin of belly wrinkled and with short reddish lines in the grooves; posterior part of caudal peduncle with a broad encircling band of dark purple, color not intense enough to obscure lengthwise lines; rays of fins yellowish, membranes pale; caudal membranes hyaline.

Remarks.—This specimen has round open nostrils with slightly raised rim, small scattered dermal spines, a conical snout, and fin ray count characteristic of *Canthigaster*. Specimens of *Arothron immaculatus* of 10 and 22 mm. have the nasal tentacles well formed and forked, snout blunt, and head and body with thickly set, long dermal spines.

The coloration is different from that of our smallest specimens of *C. solandri, janthinopterus,* or *rivulatus*. The National Museum collection has no specimens small enough for comparison, only of *solandri* and these do not have the lengthwise reddish lines mentioned in the description above.

Family TETRAODONTIDAE

By Loren P. Woods and Leonard P. Schultz

Genus AROTHRON Müller

Arothron Müller, Abh. Akad Wiss. Berlin, p. 252, 1839 (type species, *Arothron testudinarius* Müller (= *Tetrodon stellatus* Bloch and Schneider)).

KEY TO SPECIES OF AROTHRON FROM THE MARSHALL ISLANDS

1*a*. Head, back, and sides with white spots.

2*a*. Body brown, belly scarcely, if any, lighter than back; head and body everywhere with small close-set white dots smaller than pupil, those of back usually smallest; basal two-thirds of pectoral, dorsal, and anal fins dark brown, usually spotted, distal third pale; caudal fin brown with small white spots almost to distal margin; lips dark with crowded small white spots ..... **A. meleagris** (Lacepède)

2*b*. Back light grayish brown with darker brown blotches; belly pale whitish; back with large round white spots, almost as large as pupil, spots smaller on caudal peduncle and caudal fin, larger and elongate on lower sides; belly with many narrow lengthwise dark lines, broader near sides, particularly well defined below pectoral fin; gill opening and pectoral fin base sometimes encircled by 3 to 5 alternating light and dark rings; lips pale ..... **A. hispidus** (Linnaeus)

1*b*. Head, back, and sides without white spots, either plain brown or with few to very numerous black spots on a lighter background coloration.

3*a*. Coloration plain light brown to dark grayish brown on back, sides, and belly with dark lengthwise parallel lines; outer caudal fin rays always black; dark ring around mouth not complete, median part of chin pale; nasal tentacles dusky, lighter than ground color of back; dorsal and anal fins pale or slightly dusky.

A. immaculatus (Bloch and Schneider)

3*b*. Background coloration pale, with few to many black spots or black blotches.

4*a*. Head and body with scattered intensely black spots, most spots about size of pupil, occasionally one nearly as large as eye; area close around anal opening usually black; ground color of back usually darker than lower sides and belly, but in very dark and very light (yellow) specimens contrast is not great; outer caudal fin rays pale; black ring around mouth complete; black ring around eye extending onto snout to nasal tentacles; nasal tentacles black; dorsal fin black on basal third, fin rays dark, membranes pale; anal fin similarly colored; both fins rarely pale, translucent.

A. nigropunctatus (Bloch and Schneider)

4*b*. Head and body profusely covered with small black spots or blotches.

5*a*. Body and head, especially sides and dorsally, with numerous small black spots, usually smaller than pupil; interspaces pale or in form of white lines; dorsal, caudal, and pectoral fins black spotted.

6*a*. Anal fin unspotted, lower sides unspotted; region around anus black; radiating pale streaks from eye; corner of mouth probably not blackish; base of pectoral with large black spots; no large black spots at base of dorsal (color description based on Bleeker, Atlas ichthyologique . . ., vol. 5, pl. 209, fig. 2, 1865)----------**A. stellatus** (Bloch)

6*b*. Anal and pectoral fins with scattered black spots; body unspotted ventrally or with some scattered indistinct spots posteriorly; no radiating pale streaks from eye; corner of mouth black; bases of dorsal, pectoral, and axil of pectoral with large black spots (probably male)----------**A. alboreticulatus** (Tanaka)

5*b*. Numerous small black blotches, dorsally, are separated by reticulated white lines; anal and pectoral fins profusely black spotted; body black spotted ventrally and underside of head finely marbled; no radiating pale streaks from eye; corner of mouth black; bases of dorsal, pectoral, and axil of pectoral with black blotches separated by white lines (probably female).

A. alboreticulatus (Tanaka)

AROTHRON MELEAGRIS (Lacepède)

PLATE 143

Tetrodon meleagris LACEPÈDE, Histoire naturelle des poissons, vol. 1, p. 505, 1798 (type locality, seas of Asia).

Tetraodon ophryos JORDAN and SNYDER, Proc. U.S. Nat. Mus., vol. 29, p. 356, fig. 3, 1905 (Tahiti).

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 10 specimens, 112 to 180 mm. in standard length.
Eniwetok Atoll: 1 specimen, 138 mm.
Rongelap Atoll: 2 stations, 2 specimens, 156 and 166 mm.
Rongerik Atoll: 1 specimen, 176 mm.
Kwajalein Atoll: 1 specimen, 168 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 170 mm.
Guam: 4 lots, 7 specimens, 128 to 188 mm.

Description.—Dorsal rays i,10 or 11; anal i,11; pectoral rays i,16 or 17 (usually i,17); branched caudal rays 4+4; gill rakers on anterior

side of first arch in 2 rows, mesial row larger 5 to 7, distal row 5 to 8, rakers alternate to those of mesial row.

Length of head 2.4 to 2.7; length of middle caudal fin rays 3.4 to 4.0; both in standard length. Snout 2.1 or 2.2; diameter of eye 4.0 to 4.4; least depth of caudal peduncle 2.9 to 3.2; length of pectoral fin 2.4 to 2.6; height of dorsal fin 1.8 to 2.2; height of anal fin 1.85 to 2.3; postorbital part of head 2.7 or 2.8; interorbital width 2.6 to 2.9; all in length of head. Angle of snout profile with axis of body 43 to 47 degrees, snout convex.

Back smoothly rounded; small slender lobate spines, length about half pupil diameter, close set over entire head and body except around mouth, eyes, gill openings, and sides of posterior part of caudal peduncle, those of lower sides and belly much longer; in some specimens these spines are very small and embedded in the wrinkled skin, in others they are absent entirely except for small patches on lower sides; nasal tentacle forked, its surface with many pits but no apparent nostril, distal margins of all fins convex, rounded.

Color in alcohol.—Ground color of head and body light reddish brown to almost black; head, body, and bases of all fins with small, close-set oval or round white spots; those of sides and underparts usually larger, sometimes these spots minute on back, often indistinct in this region; white spots numerous around mouth; a ring of larger evenly spaced white spots around eye; dermal spines white, giving the skin a hoary appearance where thick set; intense black pigment spots sometimes present on sides; bases of pectoral, dorsal, and anal fins usually brown, spotted with white, dark color extending onto one-third to two-thirds of fin, distal margin pale or contrasting white; ground color and white spots on caudal almost to tip, distal margin pale.

Color of yellow phase.—Tip of snout dusky, middle part of back from interorbital to upper base of caudal with pale brown ground color and numerous minute white dots; lower sides and belly pale yellowish white, scattered small dark brown or black spots, smaller than pupil on lower sides and belly; area around gill openings dusky brown, anus brown; dorsal and caudal fins dusky basally with faint pale spots, broad margin pale; anal pale with faint dusky submarginal band; pectoral fin dusky basally with broad margin pale.

AROTHRON HISPIDUS (Linnaeus)

PLATE 142,E

Tetraodon hispidus LINNAEUS, Systema naturae, ed. 10, p. 333, 1758 (type locality, India).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 2 specimens, 225 and 280 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 283 mm.
Guam: 1 lot, 2 specimens, 198 and 205 mm.

Description.—Dorsal rays i,9 to 11; anal i,9 or 10; pectoral rays i,15 to 17, branched caudal rays 4+4; gill rakers in three rows, 4 to 6 rakers per row, total 14 to 18, inner row rakers largest, small tubercles in between rakers not counted.

Length of head 2.0 to 3.0; length of middle caudal rays 2.7 to 3.6; both in standard length. Snout 2.0 to 2.3; diameter of eye 4.1 to 4.5; least depth of caudal peduncle 2.7 to 3.4; length of pectoral fin 2.5 to 2.9; height of dorsal fin 1.7 to 2.1; height of anal fin 1.8 to 2.4; post-orbital part of head 2.5 to 3.0; interorbital width 2.6 to 3.1; all in length of head. Angle of snout profile with axis of body 26 to 29 degrees, snout slightly convex in region of nostrils, slightly concave just behind teeth.

Back smoothly rounded; dermal spines most prominent on breast or belly, sometimes in small patches about the size of eye, small spines evident, though imbedded, in skin of back and nape; interorbital concave; nasal tentacle forked, sensory pits present on opposing sides; anal fin originates under or slightly posterior to insertion of last dorsal ray; distal margins of fins rounded.

Color in alcohol—Ground color of head and back rich reddish brown to pale greyish brown with darker brown blotches; round white spots about size of pupil everywhere on head and back, white spots smaller on caudal peduncle and caudal fin, larger on lower sides near belly and on throat, on lower sides near breast white spots elongate; under parts white with many lengthwise narrow dark brown lines; lips pale; eye with 2 or 3 broken concentric light lines; gill opening and pectoral fin sometimes encircled by 2 to 5 alternating light and dark rings; base of pectoral fin near gill opening white, then dark with light round spots in front of articulations of rays, rest of fin pale; dorsal fin brown at base with white spots, distal three-fourths pale; caudal fin brown with small white dots over basal two-thirds, distal third plain dusky.

AROTHRON IMMACULATUS (Bloch and Schneider)

Tetrodon immaculatus Bloch and Schneider, Systema ichthyologiae . . ., p. 507, 1801 (based on *T. sans-tache* of Lacepède, vol. 1, p. 486, pl. 24, fig. 1, 1798; type locality, not given).

SPECIMEN STUDIED

Guam: Ylig Bay, July 24, 1945, M. H. Markley, 1 specimen, 106 mm.

Description.[30]—Dorsal fin rays ii,8; i,8 or i,9; anal i,8; ii,8; or i,9; pectoral rays ii,15 or 16; branched caudal rays 4+4; gill rakers in one or two rows 7 to 14, median rakers larger than outer, outer row sometimes irregular or absent.

[30] Numerous specimens from the Philippine Islands of both the striped form *A. manillensis* (Procé) and *A. immaculatus* (Bloch and Schneider) were examined. The ranges of counts and proportions given here are from USNM 51985 (100 and 120 mm.), plain colored, USNM 142841, with a striped pattern, and USNM 124014, the last one from Guam.

Length of head 2.3 to 2.8; length of middle caudal rays 2.5 to 2.9; both in standard length. Snout 2.2 or 2.3; diameter of eye 3.1 to 3.9; least depth of caudal peduncle 2.5 to 3.4; length of pectoral fin 2.4 to 2.7; height of dorsal fin 2.0 to 2.2; height of anal fin 2.1 to 2.4; postorbital part of head 2.9 to 3.3; interorbital width 2.8 to 3.2; all in length of head. Angle of snout profile with axis of body 34 to 40 degrees, snout straight to slightly convex.

Back smoothly rounded, dermal spines present in all specimens examined, short and imbedded in adults, more prominent in young, evenly distributed over head and body except for naked ring around mouth and posterior two-thirds of caudal peduncle; nostril tentacle prominent, forked; interorbital concave; anal fin originates under insertion of last dorsal ray; distal margin of caudal fin very much rounded, almost semicircular.

Color in alcohol.—Back, upper parts of head, and upper sides dark greyish brown; dark ring around mouth not meeting on chin; lower parts of head, sides, and belly whitish; back and sides with 16 to 18 continuous lengthwise black lines, broader on back and sides, narrower on belly; three median dorsal lines running from region of nostrils posteriorly and converging around base of dorsal fin, next line lateral to these meets its fellow, forming a V on the dorsal part of the caudal peduncle; two lines of the side form a ring around the anterior margin of gill opening, 5 thin lines originate on cheek and curve posteroventrally onto belly where they are sometimes interrupted or obscure, fourth line of cheek may have a branch that curves around posterior and dorsal rim of orbit; nasal tentacles pale; pectoral fin dark at base, rest of fin pale; dorsal fin dusky basally and on anterior rays; anal fin pale; caudal fin dusky mesially, outer rays and narrow distal submarginal area intensely black, tips of rays white.

AROTHRON NIGROPUNCTATUS (Bloch and Schneider)

PLATE 136,C,D

Tetrodon nigropunctatus BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 507, 1801 (type locality, Tranquebar).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 19 specimens, 49 to 157 mm. in standard length.
Eniwetok Atoll: 2 stations, 4 specimens, 108 to 145 mm.
Rongelap Atoll: 3 stations, 10 specimens, 118 to 150 mm.
Rongerik Atoll: 2 stations, 2 specimens, 88 to 107 mm.
Guam: 3 lots, 9 specimens, 63 to 171 mm.
Saipan: 1 lot, 3 specimens, 180 to 230 mm.

Description.—Dorsal rays i,9 or 10; anal i,9 to 11; pectoral rays i,16 or 17; branched caudal rays 4+4; gill rakers on anterior side of first arch 15 to 26 in 2 or 3 irregular rows.

Length of head 2.3 to 2.6; length of middle caudal fin rays 3.0 to 3.3; both in standard length. Snout 2.0 to 2.5; diameter of eye 3.5 to 3.8; least depth of caudal peduncle 2.8 to 4.2; length of pectoral fin 2.4 to 2.9; height of dorsal fin 1.7 to 2.1; height of anal fin 1.8 to 2.5; postorbital part of head 2.9 to 3.4; interorbital width 3.2 to 4.3; all in length of head. Angle of snout profile with axis of body 36 to 48 degrees, snout usually convex, sometimes only slightly convex or straight.

Back smoothly rounded; skin of head and body with short close-set, blunt spines, usually covering entire head and body except middle of back just anterior to dorsal fin, area around mouth, and sides of caudal peduncle, spines sometimes very short, embedded or absent over most of body but tips usually evident; interorbital flat, though appearing concave because of slightly protruded eyes; nasal tentacle forked; anal fin originates posterior to insertion of last dorsal ray; distal margins of fins rounded.

Color in alcohol.—Ground color of back pale greyish brown to black, sides and belly usually lighter, area around mouth and eyes brownish black, anal opening black, intensely black dots of varying sizes scattered over body; gill opening and pectoral fin base usually dark brown to black; a light band usually crosses snout just anterior to eyes in specimens having back and snout dark; nasal tentacle black; tips of dermal spines white; pectoral fin dark at base, rest of fin dusky or pale; dorsal fin usually black on basal third, rays dark, membranes pale, distal third pale; anal fin similarly colored or with base and distal part pale, only the middle rays dark, or entire fin pale; caudal fin with outer rays pale, middle rays dark, hind margin pale or entire fin uniform dusky.

Color in life.—Ground color of back varying from very dark brown to white, belly paler than back (except in white specimens); fin bases, gill openings, areas around mouth, and around eyes dark brown; nasal tentacles black; scattered black spots as large as pupil or smaller on body; dermal spines white; iris yellow; pectoral, dorsal, and anal fin rays bright yellow on distal half or third of fin; middle caudal fin rays same as color of back, middle membranes with a tinge of yellow, outer rays pale, distal margin of fin white.

AROTHRON ALBORETICULATUS (Tanaka)

PLATE 145,A,B,C

Tetraodon alboreticulatus TANAKA, Journ. College Sci. Imp. Univ. Tokyo, vol. 23, p. 42, pl. 1, fig. 5, 1908 (type locality, Misaki, Japan).—TANAKA, Figures and descriptions of the fishes of Japan, vol. 19, p 321, pl. 87, fig. 284, 1915 (Sagami Sea).—ABE, Japanese Journ. Ichthyol., vol. 3, pp. 122–125, pl. 1, 1954 (off Fukushima or Ibargi Prefecture, north of Tokyo and Manazuru, Sagami Bay).

SPECIMENS STUDIED

Bikini Atoll: Bikini Island, ocean reef, March 22, S–46–15, Schultz and Brock, 1 specimen, female 491 mm. in standard length; USNM 140772.

Bikini Atoll: Bikini Island, ocean reef, speared in grotto on lithothamnium ridge, July 17, 1946, Univ. Washington, 1 specimen, male, 480 mm.; USNM 152982.

Bikini Atoll: 1½ miles west of Bikini Island in lagoon at 20 fathoms depth, July 23, 1946, Univ. Washington, 1 specimen, male, 620 mm.

Eniwetok Atoll: Oct. 17, 1954, Halstead; USNM 164483.

Description.—The counts are recorded respectively for the three specimens: Dorsal rays i,10; i,10 and i,10; anal i,10; i,10 and i,10; pectoral i,16–i,17; i,16–i,17 and i,16–i,17; branched caudal rays always 4+4.

Measurements made on the three specimens are recorded in table 132 in thousandths of the standard length. The following proportional measurements were made: Length of head 2.5 to 2.8; depth of body 2.8 to 3.3; both in standard length. Snout 1.7 to 2.7: eye (bony orbit) 4.7 to 5.5; least depth of caudal peduncle 2.4 to 2.8; length of pectoral fin 2.6 to 3.0; height of dorsal fin 1.9 to 2.2; of anal fin 2.0 to 2.2; length of caudal fin 1.4 to 1.5; postorbital part of head 2.5 to 2.9; interorbital width 2.2 to 2.4; all in length of head. Angle of snout profile with lengthwise axis of body about 30 to 35 degrees.

Back smoothly rounded; head somewhat angular; interobital flatish; snout profile almost straight to slightly convex; dorsally head and body with close-set minute spinules except on posterior part of caudal peduncle, bases of all fins, and top of snout; nasal tentacle forked, lateral line white and distinct without supra-anal branch; distal margins of dorsal and anal fins rounded; pectoral rounded to almost straight; caudal rounded to truncate.

Color in alcohol.—The 491 mm. female specimen: Top of head, cheeks, and back light grayish brown with small, close-set dark brown to blackish spots, about 1.5 to 3.5 mm. in diameter; spots on cheeks and sides mostly round, those of top of snout, head, and back

TABLE 132.—*Measurements on three specimens of* Arothron alboreticulatus *expressed in thousandths of standard length*

Standard length in mm.	491	480	620
Head	354	390	392
Depth	305	358	360
Snout	175	221	213
Eye	75	73	77
Least depth of caudal peduncle	135	143	164
Length of pectoral fin	122	154	137
Height of dorsal fin	190	185	197
Height of anal fin	163	202	194
Length of caudal fin	247	269	268
Postorbital part of head	141	137	142
Interorbital	161	164	168

mostly elongate curved, about 2 to 3 times as long as broad. Spots broader than interspaces giving back appearance of black spots on a light background; lower velum and lower lip from rictus halfway to center black, rest of lower lip and upper lip pale; opercular opening from upper edge of pectoral around dorsal and anterior parts of opercular flap black; pale across base of pectoral but further back on pectoral base 3 or 4 round black spots about size of pupil; pectoral axil with 2 large irregular black blotches; area around anal opening pale, just inside opening two black spots that might be visible if belly were distended; lower sides dark gray with fairly distinct line of demarkation from dirty white color of belly; tiny spines all over back; sides and belly whitish; dorsal, anal, and caudal with numerous round brown spots almost to tip, larger than those of body, spots of dorsal and anal arranged in rows, about 10 rows on dorsal, 5 on anal, spots of caudal all over fin basally but confined to rays distally, membranes white; pectoral faintly spotted, rays dark, membranes pale.

The 480 mm. male specimen: Head, back, and sides profusely covered with dark brown to black spots, mostly round or oval but some angular, separated by light brown interspaces narrower than diameter of spots on back, equal to or wider than diameter of spots on sides and below; belly and ventral parts of head and caudal peduncle dirty brown, without spots; spots smallest around cheeks and top of snout, largest around bases of pectoral fins (4 to 6 spots on anterior part, 3 to 4 large spots almost as large as eye on axil) and large around base of dorsal fin; dorsal fin spotted nearly to margin, spots on rays only, in about 10 or more rows across fin; caudal fin spotted nearly to margin, mostly on rays in an irregular fashion; anal spots sparser, on rays only, in roughly 6 or 7 rows across fin; lips light brown except on lower corner of mouth from rictus to halfway to center with black, the color spilling over ventrally onto chin; opercular opening light colored inside; membrane pale on posterior edge.

The 620 mm. male specimen: Head, back, and sides profusely covered with dark brown to black angular oblong spots separated by narrow white to brownish reticulate lines, much narrower than diameter of spots; belly and ventral area of head lighter, with scattered patches of spots on light background; spots smaller around mouth and on cheeks, largest around bases of dorsal and pectoral fins, especially large in axil of pectoral which contains about 4 large angular spots, larger than eye across base of the fin; fins all spotted, especially on rays and to a less extent on membranes of pectorals, dorsal, and anal, these spots usually larger than those on body and not arranged in definite rows across fin; lips pale, except lower lip from rictus about halfway to center black; opercular membrane dark brown; light vertical bar about as long as opercular opening and just anterior to

it; opercular opening pale internally; area around anal opening black with white to gray irregular lines and blotches; dermal spines of back and sides whitish.

Lateral line system a distinct white, thin line observable on head circling eye, one branch across snout midway between eye and tip of snout, another branch down vertically across cheek starting midway between eye and opercular opening; the main branch of the lateral line rising above opercular opening on top of head or occiput, then sloping evenly and gradually downward to a point on caudal peduncle just above posterior edge of base of anal fin from which it angles posteriorly toward base of caudal fin.

Ecology.—This species occurred in the lagoon and on the ocean side of the reefs in deep surge channels where wave action was severe. The largest specimen was taken on hook and line in Bikini lagoon.

Suborder Diodontina

Family DIODONTIDAE

By Loren P. Woods

Genus DIODON Linnaeus

Diodon Linnaeus, Systema naturae, ed. 10, vol. 1, p. 334, 1758 (type species, *Diodon hystrix* Linnaeus).

DIODON HYSTRIX Linnaeus

Plate 144,C

Diodon hystrix Linnaeus, Systema naturae, ed. 10, p. 335, 1758 (type locality, India).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 5 specimens, 260 to 380 mm. in standard length.
Guam: 1 lot, 2 specimens, 324 and 345 mm.

Description.—Dorsal fin rays ii,12 or 13; anal rays ii,12 or 13; pectoral rays i,21 or 22; branched caudal rays 4+3; gill rakers rudimentary, 6 on anterior side, first arch, short, fleshy, conical.

Depth of body about 3.1 to 3.4; width of body 2.6 to 3.0; length of head 2.6 to 2.75; all in standard length. Snout 2.4 to 2.5; eye 3.8 to 4.1; least depth of caudal peduncle 4.3 to 5.1; length of pectoral fin 2.0 to 2.5; length of longest dorsal ray 2.0 to 2.3; length of longest anal ray 1.9 to 2.2; length of middle caudal rays 1.6 to 1.8; postorbital part of head 2.2 to 2.4; interorbital 1.4 to 1.6; all in length of head. Angle of snout profile about 48 to 50 degrees, slightly concave.

Interorbital slightly concave, spines of forehead commencing about even with level of middle of eyes above nostrils; spines of forehead shortest, those above and behind pectoral longest; nostrils a short

tube closed at end with small opening on either side near tip; upper and lower rays of pectoral longer than middle rays; dorsal and anal lobate, caudal rounded.

Color in alcohol.—Ground color of head and body whitish or yellowish cream-colored; snout, cheeks, top of head, back, and sides everywhere with numerous small round black dots, these dots much more numerous than spines, dots slightly larger on sides about level of dorsal fin; lips, interorbital area, and area around dorsal fin sometimes light brownish; breast and belly pale white without spots, a broad brown band running from below gill opening forward along lower side across throat joining similar band from other side, sometimes an indistinct dark bar from eye joining band below eye and sometimes dark color extending forward on chin; dorsal, anal, and pectoral fins with small round dots on basal half; caudal similarly spotted almost to tip.

Color in life.—The same as the preserved specimen.

Order GOBIESOCIDA (=Xenopterygii)

Family GOBIESOCIDAE

By Leonard P. Schultz

Genus LIOBRANCHIA Briggs

Liobranchia Briggs, Stanford Ichthyol. Bull., vol. 6, p. 133, 1955 (type species, *Liobranchia stria* Briggs).

LIOBRANCHIA STRIA Briggs

Liobranchia stria Briggs, Stanford Ichthyol. Bull., vol. 6, p. 133, fig. 112, 1955 (type locality, Saipan Island).

SPECIMENS STUDIED

Saipan Island: Collected by P. E. Cloud, 1 specimen, 18.3 mm. in standard length (holotype, USNM 179910).

Bikini Atoll: Lagoon reef halfway between Bikini and Amen islands, July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 1 specimen, 15.5 mm.

Description.—(After Briggs.) Dorsal rays vii; anal vii; pectoral xxiv; caudal viii.

Greatest depth of body 5.0; length of head 3.2; width of head 3.7; length of disc 4.2; all in standard length. Least depth of caudal peduncle 1.2 in its length. Snout 3.5; eye 4.1; both in length of head. Eye 1.1 in bony interorbital.

Body compressed; anus slightly closer to origin of anal fin than to rear margin of disc; snout short and rounded in dorsal outline; anterior nostril simple, without a dermal flap on the margin; posterior nostril in front of anterior edge of eye. Upper attachment of gill membrane opposite eighth pectoral ray. Upper attachment of axial

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dermal flap opposite sixth pectoral ray. Six rows of flattened papillae across width of each of anterior and posterior margins of disc.

Remarks.—The specimen from Bikini was plain light pink when caught. It does not have the prominent fleshy vertical ridges as described for the holotype. Otherwise it is the same, except the pectoral rays are 21 and 22. I count only 22 and 23 on the holotype, not 24 as recorded by Briggs.

Order ANTENNARIIDA

Family ANTENNARIIDAE: Anglers; Frogfishes

By Leonard P. Schultz

In order to identify with some confidence the frogfishes collected from the Marshall and Marianas islands, it was necessary for me to review the fishes of this relationship on a world basis. The results of that study was published in the Proceedings of the U.S. National Museum (vol. 107, No. 3383, pp. 47–105, figs. 1–8, pls. 1–14, 1957; vol. 116, No. 3500, pp. 171–182, pls. 1–3, 1964). Three new species (*Phrynelox lochites*, *Antennarius japonicus*, and *A. indicus*) were described in the latter paper. These have not been added to the key below.

Frogfishes may be recognized by the following characters: body globular shaped; skin more or less rough, caused by minute denticles; pectoral fin limblike; gill opening restricted to a pore near or a little behind the pectoral "elbo"; first dorsal spine, if free, with "bait" at distal end; second and third spines separate, sometimes embedded or partly covered with skin, a fourth free dorsal spine completely embedded, followed by the soft dorsal fin; caudal fin rays usually divided, one of the outer rays occasionally simple, and number 4+5; gill rakers poorly developed on first gill arch; gill filaments on first arch greatly reduced on dorsal part of arch or lacking; mouth almost vertical; small conical teeth in rows on jaws, vomer, palatines, and tongue.

Since various species of frogfishes are widely distributed, a key to those in the tropical Indo-Pacific is included. For references and synonymy, see my review of this family.

In my 1957 paper, an error was made in the description of *Antennarius pauciradiatus*. The pelvic fin does not have the last ray divided as shown in figure 7. All anal rays are divided and not as in figure 7. This species with undivided pelvic rays would trace through the 1957 key to section 49a on p. 61 and is close to *A. notophthalmus* from which it differs in having a very short "bait."

KEY TO THE FAMILY ANTENNARIIDAE OF THE INDO-PACIFIC

1*a*. Dorsal half of first gill arch without filaments, ventral part with only anterior half bearing filaments; no dermal cirri at tip of chin or on snout

in front of base of first dorsal spine; a small flaplike cirrus at symphysis of premaxillaries between dentigerous parts. (Subfamily Antennariinae.)

2*a*. First, second, and third dorsal spines embedded, covered with granular skin; "bait" not externally visible; soft dorsal and anal fins membraneously attached to base of caudal fin; soft dorsal rays 12 or 13; anal 7; pectoral 8. (East Indies, Karakelang, and Roti islands; genus *Golem* Whitley.)----------**G. cryptacanthus** (Weber)

2*b*. First dorsal spine freely movable, not embedded, usually bearing "bait" at distal tip.

3*a*. Second dorsal spine slender, elongate, its length contained fewer than 2.8 times in length of base of soft dorsal fin.

4*a*. Pectoral rays 7; first dorsal spine long, slender, hairlike, smooth, bearing at its tip a simple bannerlike tentacle; third dorsal spine very elongate and slender, much longer than second; unusually elongate upstanding denticles on skin even on fins; all soft dorsal, pelvic, and pectoral rays simple; anal rays all divided; caudal peduncle distinct; all fin rays notably elongate; dorsal soft rays 11; anal 7. (Genus *Tathicarpus* Ogilby.)---**T. butleri** (Ogilby)

4*b*. Pectoral rays 9 to 11; first dorsal spine not as above, third dorsal spine robust, shorter than or same length as second.

5*a*. (See 5*b* and 5*c*.) Skin prickly or covered with granules; caudal peduncle distinct; first dorsal spine very slender, almost hairlike, about as long as or longer than second dorsal spine; first spine bristly and with filamentous tip. (Genus *Trichophyrne* McCulloch and Waite.)

6*a*. Soft dorsal rays 12; ocellate dark spot basally at second third of length of soft dorsal fin. (Philippines.)
T. rosaceus (Smith and Radcliffe)

6*b*. Soft dorsal rays 13 or 14, skin covered with upstanding spiniform bristles. (Australia.)----------**T. mitchelli** Morton

5*b*. Skin smooth, at most with only scattered microscopic size denticles; caudal peduncle absent or nearly so; first dorsal spine short with bulbous tip; dorsal soft rays 12; anal 7; pectoral 9. (Philippines; genus *Nudiantennarius* Schultz.)
N. subteres (Smith and Radcliffe)

5*c*. Skin without denticles but these replaced by a profusion of fleshy tentacles or cutaneous appendages everywhere; bait trifid, two large tentacles with a stubby one basally between them; last pelvic ray simple; soft dorsal rays 13; anal 8; pectoral 11. (Southern Australia; genus *Rhycherus* Ogilby.)
R. filamentosus (Castelnau)

3*b*. Second dorsal spine robust like the third, short, its length contained 3 or more times in the length of base of soft dorsal fin.

7*a*. Gill opening behind pectoral fin "elbo" by a distance equal to or greater than least depth of the distinct caudal peduncle; soft dorsal rays 12; anal 7; pectoral 9. (Hawaiian Islands; genus *Abantennarius* Schultz.)----------**A. duescus** (Snyder)

7*b*. Gill opening adjacent to anal fin origin, far behind pectoral fin "elbo"; pectoral rays 10----------**A. analis** Gosline

7*c*. Gill opening adjacent to pectoral fin "elbo."

8*a*. Soft dorsal rays 15 or 16.

9*a*. Skin smooth, at most with only microscopic size spicules; caudal peduncle absent; none of soft rays of dorsal or anal fins divided. (Genus *Histiophryne* Gill.)

10*a*. Pectoral rays 8; second and third dorsal spines not movable, covered with thick skin. (Southern Australia.)
H. bougainvilli (Cuvier and Valenciennes)

10*b*. Pectoral rays 10 or 11; second and third dorsal spines movable. (Southern Australia.) **H. scortea** McCulloch and Waite

9*b*. Skin everywhere covered with bristles; caudal peduncle distinct or nearly so; anal rays 8 to 10; pectoral 10 or 11. (Genus *Echinophryne* McCulloch and Waite.)

11*a*. First dorsal spine stout, covered with prickles; body covered with upstanding bristles; none of soft dorsal or anal rays divided. (South Australia.)
E. crassispina McCulloch and Waite

11*b*. First dorsal spine slender, smooth, with simple tentacle; last few soft dorsal rays and anal rays divided. (Western Australia.) **E. glauerti** Whitley

8*b*. Soft dorsal rays 11 to 14.

12*a*. Fleshy tip of first dorsal spine consists of distinct bifid or trifid tentacles, often with filaments, but usually without basal filaments; anal rays 6 or 7; last 2 or 3 rays of soft dorsal divided; all anal rays divided; all pectoral rays simple; caudal peduncle distinct. (Genus *Phrynelox* Whitley.)

13*a*. Bifid tentacles at tip of first dorsal spine; dorsal soft rays usually 11 or 12, rarely 13; pectoral 10 or 11; bony part of first dorsal spine almost twice length of second dorsal spine. (Subgenus *Phrynelox*.)

14*a*. Body striped with brown markings more or less resembling a zebra. (Western tropical Pacific and Indian oceans.)
P. striatus (Shaw)

14*b*. Body somewhat mottled or plain blackish, with ocellate spots. (Tropical Western Pacific and Indian oceans.)
P. melas Bleeker

13*b*. Trifid tentacles at tip of first dorsal spine (rarely is one of these tentacles missing from injury); dorsal soft rays usually 12. (Subgenus *Triantennatus* Schultz.)

15*a*. Pectoral rays 10, occasionally 9 or 11.

16*a*. Body striped with dark brown markings on a pale background, more or less zebralike.

17*a*. About 4 to 6 dark stripes on soft dorsal fin, other widely spaced ones on body; pectoral rays 9 or 10. (Hawaii.) **P. cunninghami** Fowler

17*b*. Dark stripes on fins and body very numerous and closely packed; pectoral rays 10, occasionally 11. (Australia.) **P. zebrinus** Schultz

16*b*. Color black; fin rays notably black, not white-tipped, except pectorals slightly pale. (Sydney, Australia.)
P. atra Schultz

15*b*. Pectoral rays 11, occasionally 10.

18*a*. Color black or dark brown; pectoral rays white-tipped. (Japan.) **P. nox** (Jordan)

18*b*. Color mottled or striped with dark brown; fins and belly dark spotted. (Japan; Mauritius.)
P. tridens (Temminck and Schlegel)

12*b*. Fleshy tip of first dorsal spine consists of a simple tentacle or is filamentous or bulbous with or without filaments or a combination of any of these.

19*a*. Bony part of first dorsal spine notably slender, fleshy tip consisting of a nonfilamentous simple slender tentacle, sometimes somewhat lanceolate.

20*a*. Caudal peduncle absent or indistinct; all rays of soft dorsal simple; skin thick and firm, covered with chagreenlike denticles; third dorsal spine bound down with skin; no naked area behind second or third dorsal spines; body mottled with brown or a very coarse network of brown; usually a dark bar across anal fin and basally across caudal fin. (*Antennatus* Schultz.)

21*a*. Pectoral rays 11, first dorsal spine usually a little longer than second dorsal spine. (Central and western Pacific and Indian oceans.)—**A. bigibbus** Lacepède

21*b*. Pectoral rays usually 10, occasionally 9; first dorsal spine about same length as second dorsal spine. (Eastern Pacific.)—**A. strigatus** Gill

20*b*. Caudal peduncle distinct; third dorsal spine movable.

22*a*. Dorsal soft rays all divided; no pelvic ray divided; body rather profusely covered with dark specks and irregularly shaped dark and light marks; pectoral rays usually 9, occasionally 10; anal 7. (Eastern and western Pacific and Indian oceans; genus *Lophiocharon* Whitley.)
L. caudimaculatus (Rüppell)

22*b*. Last 2 or 3 or none of the soft dorsal rays divided; pectoral rays 10 to 12; bony part of first dorsal spine as long as or longer than second dorsal spine; dorsal soft rays 12 or 13, only last 2 or 3 soft dorsal rays divided; pectoral rays 10 to 12; anal rays 8 or 9; color dark brown, spotted with blackish; some ocellate spots present. (Central and western tropical Pacific Ocean; Subgenus *Uniantennatus* Schultz.)—**L. horridus** Bleeker

19*b*. Fleshy tip of first dorsal spine consists of a group of filaments or a ribbonlike tentacle with filaments or tentacles or a bulbous tip or combination of these. (Genus *Antennarius* Lacepède.)

23*a*. All or at least last 8 of the soft dorsal rays divided.

24*a*. All of the pelvic soft rays divided; caudal peduncle distinct, "bait" consists of a tuft of tentacles or a bulbouslike "bait"; soft dorsal rays usually 13; anal 8; bony part of first dorsal spine shorter than or about as long as second dorsal spine; all pectoral rays divided (except possibly in *A. sarasa*); pectoral rays 13. (Subgenus *Fowlerichthys* Barbour.)

25*a*. Soft dorsal rays all divided except possibly first 2 or 3 in small specimens; an ocellate spot posterobasally

on soft dorsal fin; scattered brown spots on fins and body. (Catalina Island; Mexico; Panama; Peru.)----------**A. avalonis** Jordan and Starks

25*b*. First 5 soft dorsal rays may be undivided, at least the last 8 are divided; no ocellate spot on soft dorsal; coloration consists of dark brown background overlaid with reticulations and dark streaks. (Japan.)----------**A. sarasa** Tanaka

24*b*. Pelvic rays all simple or undivided; caudal peduncle absent; pectoral rays 9; dorsal soft rays 13; body profusely marked with small brown spots or blotches on a pale background, some of these dark blotches have pale centers on caudal fin or color is plain black with tips of rays white; median fins distally broadly margined with white.

Lophiocharon caudimaculatus (Rüppell)

23*b*. None or only last 2 or 3 rays of soft dorsal divided: none or only last pelvic ray divided; anal rays all divided except possibly first; pectoral rays all simple. (Subgenus *Antennarius* Lacepède.)

26*a*. Bony part of first dorsal spine longer than second dorsal spine.

27*a*. Body without "warts" on skin.

28*a*. Body striped with black or brown marks, more or less zebralike; bony part of first dorsal spine about same length as second dorsal spine, fleshy tip consisting of an elongate filamentous tentacle; an ocellus may occur basally in soft dorsal fin; dorsal rays 13; anal 7; pectoral 10. (Philippines, East Indies, Japan.)

A. hispidus (Bloch and Schneider)

28*b*. Body not striped like a zebra.

29*a*. Dorsal soft rays 13; anal 8; pectoral 11; large adults have a profusely black spotted and reticulated color pattern, whereas small specimens have a few ocellate spots on fins and body; no smooth pit behind second dorsal spine. (Tropical Pacific.)

A. moluccensis Bleeker

29*b*. Dorsal soft rays 11 or 12; anal 6 or 7; pectoral 10.

30*a*. Color white or nearly so, finely peppered with dark dots on body and fins. (Western Pacific.)----------**A. leucosoma** Bleeker

30*b*. Color not as above; two color phases occur or a combination of these may occur; one is black with tips of rays of paired fins white; the other color phase is usually mottled light brownish and marked with ocellate spots; occasionally ocellate spots are visible in the black color phase; bait usually consists of a ribbonlike tentacle with filaments, or a tuft of filaments; abdomen with scattered but numerous small blackish ocellate

spots in pale color phase; naked area behind second dorsal spine becomes denticulate on the large adults of this species; no dark spot each side of third dorsal spine. (Indo-Pacific.)_____**A. chironectes** Lacepède

27*b*. Body with some warts; last 3 soft dorsal rays divided; caudal peduncle distinct, longer than deep; dorsal 11 or 12; anal 6 or 7; pectoral 10; no pelvic ray branched. (Western Pacific and Indian oceans.) **A. phymatodes** Bleeker

26*b*. Bony part of first dorsal spine about as long as or shorter than second dorsal spine.

31*a*. Body striped with dark brown; more or less zebralike; dorsal rays 13; anal 7; pectoral 10, rarely 11. (Western Pacific and Indian oceans.) **A. hispidus** (Bloch and Schneider)

31*b*. Body not striped like a zebra; anal rays 7 or 8.

32*a*. Soft dorsal rays 13; pectoral 11 or 12; anal 7 or 8; belly with scattered blackish or dark brown spots (absent in young) notably larger than dark spots elsewhere if latter present; fleshy tip of first dorsal spine with some blackish tentacles; only last 2 or 3 and last pelvic rays branched; caudal peduncle scarcely present. (Eastern Pacific.)_____**A. sanguineus** Gill

32*b*. Soft dorsal rays normally 11 or 12, rarely 13; anal rays normally 7, occasionally 8.

33*a*. Caudal peduncle absent or scarcely present, dorsal and anal fins join at or very close to base of caudal fin rays; last two or three rays of soft dorsal divided; last pelvic ray divided; dorsal rays 11; no ocellate spot in soft dorsal; pectoral rays 11 or 12; median fins finely brown spotted; background color brownish to light brownish, mottled or finely spotted. (Hawaii, Cocos Island.) **A. drombus** Jordan and Evermann

33*b*. Caudal peduncle present, distinct.

34*a*. Color black; body with minute white specks; no ocellate spot; dorsal 12; anal 7; pectoral 9; last pelvic ray undivided. (Western Pacific.)_____**A. dorehensis** Bleeker

34*b*. Color not as above.

35*a*. Last pelvic ray simple or undivided; pectoral rays 9, rarely 10; ocellate spot on soft dorsal fin; blackish bar on body below area between third dorsal spine and origin of soft dorsal. (Western Pacific.) **A. notophthalmus** Bleeker

35*b*. Last or fifth pelvic ray divided; pectoral rays normally 9 or 10.

36*a*. Pectoral rays usually 9, occasionally 10; general coloration dark brown and

somewhat dark spotted, but cirri on body are usually white; median fins notably dark brown except distally with broad white or pale edges; a pale bar across caudal fin basally. (Western Pacific.)

A. altipinnis Smith and Radcliffe

36*b*. Pectoral rays normally 10, occasionally 11; usually an ocellate spot basally on soft dorsal fin at about beginning of last third of its length; background color light tan to dark brown, usually somewhat mottled, a smooth pit or area behind second dorsal spine. (Central, western Pacific, and Indian oceans.)------**A. nummifer** (Cuvier)

1*b*. Dorsal half of first gill arch with the posterior half only bearing filaments; ventral half of first gill arch with gill filaments along its entire length; two dermal cirri on middorsal line of snout in front of base of first dorsal spine; no dermal flap at symphysis of premaxillaries. (Pelagic in Pacific, Atlantic, and Indian oceans; subfamily Histriinae; genus *Histrio* Fisher.)----------**H. histrio** (Linnaeus)

Genus TRICHOPHRYNE McCulloch and Waite

Trichophryne McCulloch and Waite, Rec. Australian Mus., vol. 1, no. 1, p. 68, 1918 (type species, *Antennarius mitchelli* Morton).

TRICHOPHRYNE ROSACEUS (Smith and Radcliffe)

Plate 146,A

Antennarius rosaceus Smith and Radcliffe *in* Radcliffe, Proc. U.S. Nat. Mus., vol. 42, p. 203, pl. 17, fig. 2, 1912 (type locality, Romblon, Philippine Islands; holotype USNM 70266).

SPECIMEN STUDIED

Bikini Atoll: Boby Island, ocean reef, S–46–383, Aug. 17, 1946, Herald, 1 specimen, 13.5 mm.

Description.—Dorsal rays I–I–I–12; anal 7, pectoral 10–10; last 2 or 3 soft dorsal rays and last pelvic ray divided; first dorsal spine a long slender threadlike ray, the bait consisting of a small bulbous knot of filaments; total length of first dorsal spine contained 1¾ times in length of base of soft dorsal, and almost as long as the slender, free second dorsal spine; the latter is more slender and elongate than in any other species of *Antennarius* observed by me. Skin behind base of second dorsal spine smooth; caudal peduncle distinct.

Color in Alcohol.—Light yellowish gray; a trace of an ocellate spot basally on soft dorsal between rays 8 to 10.

Remarks.—The slender second dorsal ray of the holotype of *A. rosaceus* is shorter than that of the Bikini specimen, otherwise there are no notable differences.

Genus ANTENNARIUS Lacepède

Antennarius (Commerson ms.) Lacepède, Histoire naturelle des poissons, vol. 1, p. 325, 1798 (type species, *Antennarius chironectes* (Commerson) Lacepède (=*Lophius commersoni* Shaw 1804 and later authors) designated by Bleeker (Atlas ichthyologique, vol. 1, p. 5, 1865)).

ANTENNARIUS ALTIPINNIS Smith and Radcliffe

Plate 146,C

Antennarius altipinnis Smith and Radcliffe *in* Radcliffe, Proc. U.S. Nat. Mus., vol. 42, p. 204, fig. 3, 1912 (type locality, Nogas Pt., Panay, Philippines; holotype, USNM 70267).

Antennarius albomarginatus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 97, p. 74, fig. 19, 1945 (type locality, Saipan; type examined by me, ANSP 71609).

Antennarius niveus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 215, fig. 75, 1906 (type locality, Riu Kiu Islands; type examined by me, ANSP 72088).

SPECIMENS STUDIED

Marianas Islands: Guam, tide pool, June 29 to July 7, 1949, Eugenie Clark, 1 specimen, 13 mm. (USNM 154625).

Also: Numerous lots from the Philippines, Palau, and Gilbert islands.

Description.—Dorsal rays I–I–I–12; anal 7; pectoral 9 and 10, usually 9; last 2 or 3 soft dorsal rays divided as is last pelvic ray; first dorsal spine shorter than second, the bait consists of a small bulbous knot of filaments; skin behind base of second dorsal spine rough; caudal peduncle distinct.

Color in alcohol.—Dark brown, somewhat mottled with lighter shades; a pale saddle below space between third dorsal spine and origin of soft dorsal; distal margins of median fins broadly whitish; the central area of these fins dark brown; caudal fin with a pale bar basally; distal half of pectoral rays pale, basally dark brown; sometimes an ocellate spot occurs on soft dorsal between bases of ninth and tenth dorsal rays.

Color when alive.—An *Albatross* Philippine color drawing shows the distal edges of median fins as yellowish; cirri on head and body white; pelvic and pectoral rays grayish yellow distally.

ANTENNARIUS COCCINEUS (Lesson)

Plate 146,B

Chironectes coccineus Lesson, Voyage . . . *La Coquille* . . ., Zoologie, vol. 2, pt. 1, p. 143, pl. 16, fig. 1, 1830 (type locality, Mauritius; Dr. de Beaufort kindly wrote to me that "the dorsal and anal end close to base of caudal" on the type, thus figure 1 is inaccurate).—Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 12, p. 430, 1837 (on Lesson).

Antennarius coccineus Bleeker, Atlas ichthyologique, vol. 5, p. 22, pl. 197, fig. 2, 1865 (Java; Cocos; Nias; Singapura; Sangi; Buro; Amboina; Ceram;

Goram).—Smith, The sea fishes of southern Africa, p. 431, pl. 98, fig. 1238, 1949 (Natal).

Antennarius stigmaticus Ogilby, Mem. Queensland Mus., vol. 1, p. 63, pl. 14, fig. 2, 1912 (type locality, Moreton Bay, Queensland).

Antennarius leucus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, p. 512, fig. 53, 1934 (Durban, Natal; type examined by me, ANSP 54955).

Antennarius punctatissimus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98 p. 216, fig. 76, 1946 (type locality, Aguni Skima, Riu Kiu Islands; type examined by me, ANSP 72089).

SPECIMENS STUDIED

Bikini Atoll: Enyu Island, reef at entrance to lagoon, S–46–8, March 16, Schultz, Brock, and Marr, 1 specimen, 40 mm.; Airy Island, ocean reef, S–46–96, April 16, Schultz, 1 specimen, 16 mm.; Arji Island, lagoon, depth 20 to 40 feet, S–46–308, August 7, Herald and Brock, 1 specimen, 40 mm.; lagoon reef halfway between Bikini and Amen Island, S–46–442, July 21, 1947, Brock, Hiatt, and Schultz, 1 specimen, 61.5 mm.; Namu Island, lagoon reef, S–46–508, August 6, 1947, Schultz, Brock, and Hiatt, 3 specimens, 33 to 64 mm.; Ion Island, August 7, 1946, Univ. Washington, 1 specimen, 47.5 mm.;

Arno Atoll: 1950, Strasburg, 1 specimen, 29 mm.

Also: 1 specimen each from Onotoa Atoll: Gilbert Islands; Tonga Island; and the Samoa Islands.

Description.—Dorsal rays I–I–I–12; anal 7; pectoral 10, rarely 9 or 11; last 2 or 3 soft dorsal rays and last pelvic ray divided; first dorsal spine about same length as second dorsal spine, the bait consisting of tentacles and filaments that form a small tuftlike knob; length of bony part of first dorsal spine contained from 4 to 6 times in length of soft dorsal base; skin behind base of second dorsal spine naked at about 45 mm., but becoming rough in the larger ones; caudal peduncle absent or nearly so, dorsal and anal fins join close to the caudal fin base.

Color in alcohol.—Light tan or grayish yellow, blotched with brownish, and usually with scattered small brownish spots ventrally and sometimes extending on sides; fins may be lightly barred with brownish; no distinct dark ocellate spot in soft dorsal fin.

Remarks.—This species is close to *A. altipinnis* and the two might be confused except for the difference in color pattern and the distinctness of the caudal peduncle in *A. altipinnis*, which in *A. coccineus* is nearly absent.

ADDENDA

By Leonard P. Schultz

Since volume 1 was printed, additional specimens from the Marshall and Marianas islands have been collected or have been found in the collections. These were studied and are reported on below. Also, a few pertinent papers have been published and are discussed in reference to volume 1.

It should be noted that volumes 1 and 2 report on the specimens available to the authors and not completely on all nominal species reported from the area of study.

Family SERRANIDAE

Volume 1, page 351

The material referred to under *Epinephelus fuscoguttatus* actually represents two species that are now distinguished and discussed below.

EPINEPHELUS FUSCOGUTTATUS (Forskål)

Figure 155

Perca summana fusco-guttata Forskål, Descriptiones animalium . . ., pp. 11, 42, 1775 (type locality, Djedda).

Serranus fuscoguttatus Rüppell, Atlas zu der Reise im Nördlichen Afrika . . . Fische des rothen Meers, vol. 4, p. 108, pl. 27, fig. 2, 1828 (Red Sea).—Day, Fishes of India, vol. 1, p. 22, pl. 5, fig. 3, 1875 (Sind).

Epinephalus fuscoguttatus Bleeker, Atlas ichthyologique, vol. 7, p. 57, pl. 307, fig. 3, 1876 (Singapura; Java; Bawean; Timor; Ternata, Waigiu).—Schultz (in part), U.S. Nat. Mus. Bull. 180, p. 108, 1943 (Hull and Canton Islands).—Marshall, Endeavour, vol. 11, No. 43, pl., 1952 (Red Sea).

Epinephelus horridus Randall, Atoll Res. Bull. 47, p. 49, 1955 (Onotoa).

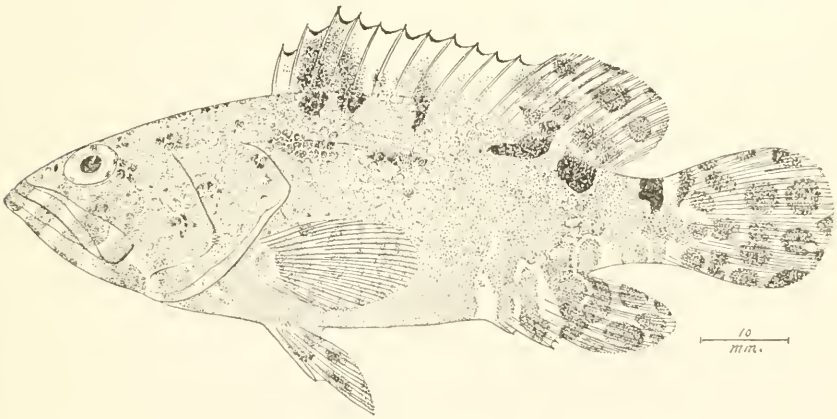

Figure 155.—*Epinephelus fuscoguttatus* (Forskål) immature specimen, after Fowler.

SPECIMENS STUDIED

Bikini Atoll: 1 specimen, 117 mm. in standard length (USNM 141945).
Eniwetok Atoll: 1 specimen, 285 mm. (USNM 152975).
Onotoa Atoll: 1 specimen, 340 mm. (USNM 167476).
Canton Island: 1 specimen, 355 mm. (USNM 115368).
Hull Island: 1 specimen, 455 mm. (USNM 115342).
Philippines: 1 specimen, 177 mm. (USNM 84202).
Red Sea: 1 specimen, 215 mm. (USNM 147593); 2 specimens, 205 and 230 mm. (USNM 147594).
Solomon Islands: New Georgia, 1 specimen, 320 mm. (USNM 164388); 1 specimen, 285 mm. (USNM 164339).

Description.—The measurements given in volume 1 for this species apply as well to *E. horridus* except for those recorded in table 133. Counts of importance are recorded in table 134.

Remarks.—In volume 1, p. 352, I stated for this species that I was unable to decide if *E. fuscoguttatus* represented 1 or 2 species. Dr. John Randall and I discussed this problem in 1954 and on the basis of 3 specimens, one each from Onotoa, Canton Island, and Eniwetok, two species were noted. Randall (Atoll Res. Bull. 47, pp. 48–49, 1955) discusses this problem and applied the name *E. horridus* to the species with the greater number of gill rakers and pectoral fin rays. I do not agree with his interpretation, because in reading Forskål's description I find that his *E. fuscoguttatus* is credited with 18 pectoral rays, a number that corresponds to that found on specimens labeled *horridus* by Randall. In the meantime, I have assembled several additional specimens from the Indo-Pacific region not avialable when Randall and I first discussed the problem. Counts are recorded in table 134.

TABLE 133.—*Measurements on two species of* Epinephelus *recorded in percent of standard length*

Species	Greatest depth of body*										Length of head								Length from snout tip to rear tip of maxillary				
	31	32	33	34	35	36	37	38	39	40	39	40	41	42	43	44	45	46	20	21	22	23	24
horridus	5	2	3	7	1	---	---	---	---	---	3	2	4	7	1	---	---	---	6	8	3	---	---
fuscoguttatus	1	1	2	1	1	3	---	1	---	1	1	---	5	1	---	2	1	1	1	4	1	4	1

*The body becomes much deeper with increase in size.

My interpretation of the data available indicates that *Epinephelus horridus* is the name that should be applied to the species with fewer pectoral rays i,15 or i,16. Since *Serranus horridus* Cuvier and Valenciennes is described with 16 pectoral rays, I am using that name for the species with fewer pectoral rays and fewer gill rakers.

Marshall (plate) illustrates a large specimen of *E. fuscoguttatus* captured in the Red Sea. The coloration of small blackish specks or

Table 134.—*Counts of some species of* Promicrops *and* Epinephelus

Genera and species	Fin rays											Rakers (including rudiments) on first gill arch																							Total number of gill rakers												
	Dorsal						Pectoral					Above angle							At angle	Below angle																																	
	XI	XII	13	14	15	16	i,15	i,16	i,17	i,18	i,19	8	9	10	11	12	13	14	1	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35								
Promicrops																																																		
itaiara	18				14	4			1	32	3	1	5	9	2				17		6	9	2									9	4	2	1															
lanceolatus	8	1		5	4				11	6			5	3					8	1	3	4							1	1	4	2																	
Epinephelus																																																		
tauvina	12		1	11						16	6	1	4						5			5							1	4																				
socialis	9			2	7				2	16		3	5	1					9					4	3	2						2	3	1	3													
horridus	21			10	11		7	31	4			1	17	3					21		3	17	1							4	13	4																	
fuscoguttatus	11			11					3	18	1				1	7	2	1	11				1	3	1	2	3		1						1	2	2	2	1	2	1						

spots all over the body appears to represent the typical color patterns of the large specimens of this species.

EPINEPHELUS HORRIDUS (Cuvier and Valenciennes)

FIGURE 156

Serranus horridus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 2, p. 321, 1828 (type locality, Java).

Epinephelus fuscoguttatus SCHULTZ (in part), U.S. Nat. Mus. Bull. 202, vol. 1, p. 351, pl. 26, fig. A, 1953 (Rongerik Atoll; Canton Island; Apia).—RANDALL, Atoll Res. Bull. 4, p. 48, 1955 (Onotoa).

SPECIMENS STUDIED

Rongerik Atoll: 1 specimen, 230 mm. in standard length (USNM 141958).

Bikini Atoll: 1 specimen, 167 mm. (USNM 141944); 1 specimen, 193 mm. (USNM 141948).

Eniwetok Atoll: 2 specimens, 205 and 325 mm. (USNM 141954).

Rongelap Atoll: 2 specimens, 320 and 370 mm. (USNM 141953); 1 specimen, 290 mm. (USNM 65821).

Onotoa Atoll: 1 specimen, 298 mm. (USNM 167475).

Arno Atoll: 1 specimen, 350 mm. (USNM 166842).

Canton Island: 4 specimens, 132 to 159 mm. (USNM 115367).

Apia, Samoa: 1 specimen, 280 mm. (USNM 52477).

Funafuti, Ellice Islands: 1 specimen, 198 mm. (USNM 65823).

Makemo, Paumotu Island: 3 specimens, young not measured (USNM 65822).

Solomons: New Georgia, 1 specimen, 270 mm. (USNM 164340).

New Caledonia: 1 specimen, 295 mm. (USNM 164341).

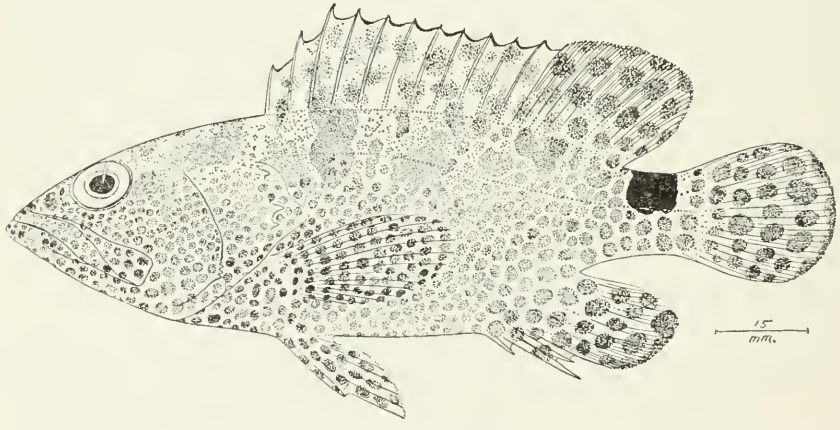

FIGURE 156.—*Epinephelus horridus* (Cuvier and Valenciennes), immature specimen, after Fowler

Description.—In addition to the differences indicated in counts recorded in table 134 between *E. fuscoguttatus* and this species, the following differences in coloration have been noted.

E. horridus has the ventral part of the body profusely dark spotted whereas the dorsal part of head and body generally lack these dark

spots. *E. fuscoguttatus* is more dark spotted dorsally on head and body than ventrally, and sometimes the ventral surface of the abdomen is unspotted or nearly so; the mottled and barred color pattern may or may not cover the abdomen. In *E. horridus* the abdomen may be brown, but in addition it is profusely brown spotted. The paired blackish blotch on the snout in the premaxillary groove in *E. horridus* is absent in *E. fuscoguttatus*.

Fowler and Bean (U.S. Nat. Mus. Bull. 100, vol. 10, p. 287, fig. 22, 1930) noted these differences as they stated "our materials seem to show two fairly constant variations in color. In the first the throat is with cross bars, the dark blotch on the caudal peduncle small and the spots on the body relatively small. The second variation is without cross bars, spot on caudal peduncle very large and spots on body large and hexagonal."

Remarks.—Randall (p. 48) states that *E. fuscoguttatus* and *E. horridus* may be distinguished by means of the number of gill rakers and the differences in greatest depth. I agree with the former statement, but in regard to the latter, my measurements of 10 specimens of *E. horridus* show that the depth is 31 to 35 percent of the standard length and that of *E. fuscoguttatus* ranges from 31 to 40 percent. The deeper bodied specimens are the largest ones as is generally true for other serranids.

Volume 1, page 372

Dr. J. L. B. Smith (Ann. Mag. Nat. Hist., ser. 12, vol. 7, p. 866, fig. 1, pl. 7, fig. B, 1954) described as new *Chorististium africanum*, from 4 specimens, one each from Pinda, Pemba, Zanzibar, and Tekomazi islands. In this same paper Dr. Smith records the occurrence of "*Chorististium susumi* Jordan and Seale" from several localities off the east African coast. However, Smith's plate 27, fig. C, shows the color pattern of *Chorististium lineata* (Schultz) and not that of *C. susumi*. I conclude therefore that *C. lineata* is the species that Smith has collected, not *C. susumi*.

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Dr. Böhlke (Notulae Naturae, Philadelphia, no. 291, pp. 1–7, pl. 1, 1956) has pointed out that I overlooked one of the almost embedded dorsal spines in *Ypsigramma lineata* Schultz and that *Chorististium rubrum* (Poey) is scaled over between dorsal fins as is *Y. lineata*. He concludes that *Ypsigramma* Schultz is a synonym of *Chorististium* Gill, with which I fully agree. Therefore, the generic name *Chorististium* must be transferred to the 1*b* section of the key on p. 373, and the 2*a* section of the key must take the next available generic name, *Pikea* Steindachner.

Table 135.—*Counts recorded for species of* Pikea, Liopropoma, *and* Chorististium

Genera and species	Fin rays																Gill rakers on first arch												
	Dorsal						Anal				Pectoral																		
	VI–I–I	VIII	IX	12	13	14	III	8	9	10	i,13	ii,10	ii,11	ii,12	ii,13	ii,14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Pikea																														
japonica		1				1	1			1													1						
aurora		4			4		4		4						8								4						
mexicana		14				14	14	14						2	21	1							6	3	1				
cubensis		4			4		4	4							8							1	3						
mowbrayi		1		1			1	1					2				1												
swalesi		2		1			2	2						4															2
lunulata		2		2			2	2						3	1					1	1								
maculata		x		x			x	x						x															
longilepis		1			1		1	1			2											1							
Liopropoma																													
aberrans			x	x			x	x																					
roseus			x			x	x	x																					
Chorististium																													
pallidum	1			1			1	1								2					1								
brocki	2			2			2	2						1	2							1							
lineata	5			5			5	5							7						2	2							
susumi	1			1			1	1							2			1	1										
africanum	x			x			x	x							1				x	x									
rubrum	3			3			3	3				3		1								1							

Counts recorded in the literature are marked with an "X."

Radiographs of the specimens available to me in this relationship have revealed that in those species now referable to *Chorististium*, all have VI–I–I dorsal spines, the seventh being embedded. Also, the vertebrae for each specimen numbers 10+14=24. As a result of my study of additional material now available to me, I present a new analysis of genera and species in the following key.

KEY TO GENERA AND SPECIES RELATED TO CHORISTISTIUM

1*a*. Spiny dorsal fin continuous with soft dorsal by a ridge of scales along sides of connecting dorsal spines; no scaled area separating spiny and soft dorsal rays; 3½ to 5½ scales in a row from lateral line to base of last dorsal spine; 16 to 21 predorsal scales to occiput.

2*a*. Dorsal spines VIII (genus *Pikea*) [31]

3*a*. Anal rays III,10; dorsal rays VIII,14; pectoral ii,14; pores in lateral line 47; zigzag scales around caudal peduncle about 40 to 42; outer edge, distally, of each caudal lobe white. (Japan.)
P. japonica (Döderlein) [32]

3*b*. Anal rays III,9; dorsal rays VIII,13; pectoral ii,13; pores in lateral line 48 to 51; zigzag scales around caudal peduncle about 45. (Hawaiian Islands.)——**P. aurora** Jordan and Evermann [33]

3*c*. Anal rays III,8.

4*a*. Pores in lateral line 43 to 47.

5*a*. Dorsal rays VIII,12.

6*a*. Pores in lateral line 43; pectoral rays ii,11; gill rakers on first gill arch about 15; tips of outer caudal fin rays black. (Bermuda.)——**P. mowbrayi** (Woods and Kanazawa) [34]

6*b*. Pores in lateral line 46 or 47; pectoral rays ii,12; predorsal scales to occiput 19 to 21; gill rakers in first gill arch about 28. (Philippines.)——**P. swalesi** (Fowler and Bean) [35]

6*c*. Pores in lateral line 44 to 46; pectoral rays i,12 or i,13; gill rakers 16 or 17; median wide black band through snout to caudal fin, broadening posteriorly; above band yellowish, below it pinkish in life. (Florida.)
P. eukrines (Stark and Courtenay) [36]

5*b*. Dorsal rays VIII,13 or 14; pectoral rays ii,13 rarely ii,12 or ii,14; pores in lateral line 46 or 47; gill rakers on first gill arch 20 to 23; tips of outer caudal fin rays usually blackish.

7*a*. Dorsal rays VIII,13. (Cuba.)——**P. cubensis** Schultz [37]

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[31] *Pikea* Steindachner, Sitzb. Akad. Wiss. Wien, vol. 69, p. 2, 1874 (type species, *Pikea lunulata* (=*Grystes lunulatus* Guichenot 1863)).

Labracopsis Döderlein *in* Steindachner and Döderlein, Anz. Denkschr Akad. Wien, vol. 20, p. 49, 1883; Denkschr. Akad. Wiss. Wien, vol. 47, p. 235, 1883 (type species, *Labracopsis japonica* Döderlein).

[32] *Labracopsis japonica* Döderlein *in* Steindachner and Döderlein, Anz. Denkschr. Akad. Wien, vol. 20, p. 49, 1883; Denkschr. Akad. Wiss. Wien, vol. 47, p. 235, pl. 6, fig. 3, 1883 (Japan).

[33] *Pikea aurora* Jordan and Evermann, Bull. U.S. Bur. Fish., vol. 22 (1902), p. 178, 1903; *ibid.*, vol. 23 (1903), pt. 1, p. 220, pl. 14, 1905 (Hilo).

[34] *Liopropoma mowbrayi* Woods and Kanazawa, Fieldiana, Zool., vol. 31, No. 53, p. 633, fig. 134, 1951 (Bermuda).

[35] *Chorististium swalesi* Fowler and Bean, U.S. Nat. Mus. Bull. 100, vol. 10, p. 186, 1930 (Gulf of Tomini, Celebes).

[36] *Chorististium eukrines* Stark and Courtenay, Proc. Biol. Soc. Washington, vol. 75, pp. 159–168, 1962 (off Florida).

[37] *Pikea cubensis* Schultz, Proc. U.S. Nat. Mus., vol. 108, p. 322, fig. 1, 1958 (off Cuba; Bahamas).

7*b*. Dorsal rays VIII,14. (Gulf of Mexico.)--**P. mexicana** Schultz [38]

4*b*. Pores in lateral line 48 to 70; gill rakers of first gill arch 18 to 20 (unknown for *P. maculata*).

8*a*. Pores in lateral line 48 to 55.

9*a*. Pectoral rays ii,13 or 14; dorsal rays VIII,12; pores in lateral line 48 to 52; zigzag scales around caudal peduncle about 40 to 42; body with numerous black spots. (Reunion Island and Mauritius.)---------**P. lunulata** (Guichenot) [39]

9*b*. Pectoral rays i,13; dorsal VIII,13; pores in lateral line 54 or 55. (Panama.)----------**P. longilepis** (Garman) [40]

8*b*. Pores in lateral line about 65 to 70; dorsal rays VIII,12; pectoral ii,13; sides of body spotted. (Japan.)

P. maculata Steindachner and Döderlein [41]

2*b*. Dorsal spines IX (genus *Liopropoma*) [42]

10*a*. Dorsal rays IX,12; pores in lateral line 45. (Cuba.)

L. aberrans (Poey) [43]

10*b*. Dorsal rays IX,14; pores in lateral line 58 (my count of drawing is 62 or 63). (Pernambuco, Brazil.)----------**L. roseus** (Günther) [44]

1*b*. Spiny dorsal and soft dorsal fins completely separated externally by a scaled area of 5 to 7 rows across back between fins; dorsal rays VI–I–I,11 or 12, the seventh dorsal spine usually embedded below scales; zigzag scales around caudal peduncle 30 to 32; pores in lateral line 45 to 48; 3½ to 5 scales in a row from lateral line to last dorsal spine; gill rakers 5 to 7+1+11 to 14 on first arch; anal rays III,8. (Genus *Chorististium* Gill.) [45]

11*a*. Coloration plain pale, no stripes or dark pigment marks on sides or on fins; pectoral rays ii,14; predorsal scales 12 to occiput; dorsal rays VI–I(embedded)I,i,11. (Christmas Island and Bikini Atoll.)

C. pallidum Fowler [46]

11*b*. Coloration of alternating dark and pale streaks or dark wavy lines on sides.

12*a*. Sides of body with brown pigment specks, a few arranged in irregular

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[38] *Pikea mexicana mexicana* Schultz, Proc. U.S. Nat. Mus., vol. 108, p. 323, fig. 2, 1958 (Gulf of Mexico).

[39] *Grystes lunulatus* Guichenot, Notes sur l'ile de la Reunion. Faunal ichthyologique, p. C–4, 1863 (Reunion Island).

Pikea lunulata Steindachner, Sitzb. Akad. Wiss. Wien. vol. 69, p. 2, 1874; Denkschr. Akad. Wiss. Wien, vol. 47, pl. 6, fig. 2, 1883.

Glaucosoma semilunifera Steindachner *in* Bliss, Trans. Roy. Soc. Mauritius, N. ser., vol. 13, p. 47, 1883 (Mauritius).

[40] *Liopropoma longilepis* Garman, Mem. Mus. Comp. Zool., vol. 24, p. 45, 1899 (Lat. 7°33′ N.; Long. 78°34′20″ W.).

[41] *Pikea maculata* Döderlein and Steindachner, Denkschr. Akad. Wiss. Wien, vol. 47, p. 234, pl. 6, figs. 1, 1a, 1b, 1883 (Japan).

[42] *Liopropoma* Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 52, 1861 (type species, *Perca aberrans* Poey).

Bathyanthias Günther, Report on . . . voyage of H.M.S. *Challenger* . . . 1873–76, Zoology, vol. 1, pt. 6, p. 6, 1880 (type species, *Bathyanthias roseus* Günther).

[43] *Perca aberrans* Poey, Memorias, vol. 2, p. 125, pl. 12, fig. 2, 1860 (Cuba).

[44] *Bathyanthias roseus* Günther, Report on . . . voyage of H.M.S. *Challenger* . . . 1873–76, Zoology, vol. 1, pt. 6, p. 6, pl. 1, fig. B, 1880 (Pernambuco, Brazil).

[45] *Chorististium* Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 15, 1862 (type species, *Perca rubre* Poey; misspelled *Chorististum* in heading).

Ypsigramma Schultz, U.S. Nat. Mus. Bull. 202, vol. 1, p. 372, 1953 (type species, *Ypsigramma lineata* Schultz).

[46] *Chorististium pallidum* Fowler, Monogr. Acad. Nat. Sci. Philadelphia, vol. 2, p. 199, fig. 20, 1938 (Christmas Island).

lines on midsides; an oblique short dark brown streak on pectoral base; predorsal scales 13 to occiput.

C. brocki (Schultz) [47]

12*b*. Coloration not as above.

13*a*. Sides of body with 7 or 8 distinct, almost straight, lengthwise dark brown streaks.

14*a*. Five brown streaks on each side of caudal peduncle; 3½ or 4 scales between lateral line and last dorsal spine; predorsal scales 12 or 13 to occiput----------**C. lineata** (Schultz) [48]

14*b*. Four brown streaks on each side of caudal peduncle; 3 scales between lateral line and second dorsal origin; predorsal scales 10 to occiput----------**C. susumi** Jordan and Seale [49]

13*b*. Four or 5 dark streaks on each side of body; 3 dark streaks on each side of caudal peduncle.

15*a*. Five dark streaks on each side of body; pectoral rays ii,12; tips of posterior lobes of median fins with black blotches. (Cuba; Bahama Islands.)----------**C. rubrum** (Poey) [50]

15*b*. Four dark streaks on each side of body; pectoral rays ii,13. (Zanzibar.)----------**C. africanum** Smith [51]

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Dr. J. L. B. Smith (Ann. Mag. Nat. Hist., ser. 12, vol. 7, p. 869, 1954) established a new genus and species, *Tulelepis canis*, and a new subfamily, Tulepinae (which should have been spelled Tulelepidinae). In volume 1 of bulletin 202, pages 386–388, fig. 62, I named a new genus and species, *Grammistops ocellatus* (which should have been spelled *ocellata*), and assigned it to the subfamily Grammistinae, along with *Rypticus* Cuvier and Valenciennes, *Pogonoperca* Günther, and *Grammistes* Bloch and Schneider. *Tulelepis canis* is identical with *Grammistops ocellata*, even to the small dark spot on each side of the chin. Smith's paper greatly extends the ranges of these aberrant genera of serraniform fishes. Undoubtedly, additional species and genera will be discovered as more extensive collecting is done in the tropical Indo-Pacific regions.

On page 373, footnote 67, I stated that *Aulacocephalus temmincki* Temminck and Schlegel probably belongs in the *Chorististium* relationship. Now that I have examined radiographs of three specimens, I conclude the genus belongs in the Grammistinae, because the first

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[47] *Ypsigramma brocki* Schultz, U.S. Nat. Mus. Bull. 202, vol. 1, p. 379, fig. 60, 1953 (Marshall and Gilbert Islands).

[48] *Ypsigramma lineata* Schultz, U.S. Nat. Mus. Bull. 202, vol. 1, p. 355, fig. 59, 1953 (Marshall and Philippine Islands).

Chorististium susumi (non Jordan and Seale) Smith, J. L. B., Ann. Mag. Nat. Hist., ser. 12, vol. 7, p. 862, pl. 27, fig. C, 1954 (Matemo Island, off East African Coast).

[49] *Chorististium susumi* Jordan and Seale, Bull. U.S. Bur. Fish., vol. 25 (1905), p. 256, fig. 48, 1906 (Apia, Samoa).

[50] *Liopropoma rubre*, Poey, Memorias, vol. 2, p. 418, 1861 (Cuba).

[51] *Chorististium africanum* Smith, J. L. B., Ann. Mag. Nat. Hist., ser. 12, vol. 7, p. 866, fig. 1, pl. 27, fig. B, 1954 (Pinda Pembra, Zanzibar, and Tekomazi Island).

two dorsal pterygiophores with a common base are separated by the third neural spine. *Aulacocephalus* has 10+14 vertebrae.

Rainfordia opercularis McCulloch (Rec. Australian Mus., vol. 14, No. 2, p. 120, pl. 16, fig. 3, 1923; type locality, Middle Island, Edgecumbe Bay, Queensland) probably belongs to the Grammistinae.

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The following genus and species was not included in volume 1 of this report.

Genus PROMICROPS Poey

Promicrops Poey, Reportorio . . ., vol. 2, p. 287, 1868 (type species, *Serranus guaza* Poey=*Serranus itajara* Lichtenstein).

Itaiara Vaillant and Bocourt, Mission scientifique Mexique, Poiss, vol. 4, p. 67, 1878 (type species, *Serranus itajara* Lichtenstein).

Phrynotitan Gill, Standard natural history, vol. 3, p. 255, 1885 (type species, *Batrachus gigas* Günther).

During 1955, Drs. Robert W. Hiatt and Donald W. Strasburg called to my attention the capture of 3 large sea basses at Eniwetok Atoll. Although counts, measurements, and photographs were furnished of these giant fishes, I was unable to identify them without examining a specimen. Thus, the smallest, weighing 337½ pounds, was shipped to the U.S. National Museum where it is now preserved.

This specimen was identified as *Promicrops lanceolatus* (Bloch) after much detailed study of small and large specimens and a comparison with specimens of *Promicrops itaiara* (Lichtenstein) in the Atlantic and eastern Pacific. *Promicrops lanceolatus* was confused with *Epinephelus tauvina* by Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 6, p. 62, fig. 7, 1931). Their figure 7 is of a specimen of *P. lanceolatus* and not *E. tauvina*.

The genera *Promicrops* and *Epinephelus* may be distinguished by means of the following characters:

Characters	*Epinephelus*	*Promicrops*
Interorbital space notably wider than eye diameter	−	+
Eye very small in adult, about 3 or 4 times in interorbital space	−	+
Gill-arches covered with numerous chagreenlike platelets	−	+
Dorsal spines shorter than least depth of caudal peduncle	−	+
Third or fourth dorsal spines longest	+	−
Seventh or eighth dorsal spines longest	−	+

Adults of *Promicrops* are easily distinguished from those of *Epinephelus* by their small piglike eyes in combination with a broad convex interorbital space and very short dorsal spines.

I have searched the literature for authentic records of large-sized *Promicrops*, all of which are recorded in table 136. The reference to the literature will be found under the synonymy listed.

PROMICROPS LANCEOLATUS (Bloch)

PLATES 147,A,B,C; 148

Holocentrus lanceolatus BLOCH, Naturgeschichte Ausländischen Fische, vol. 4, p. 92, pl. 242, fig. 1, 1790 (type locality, East Indies).—WALBAUM, Petri Artedi sueci Genera Piscium, vol. 3, p. 645, 1792 (on Bloch, East Indies).—FORSTER, Fauna Indica, p. 16, 1795 (ref. copied).—BLOCH and SCHNEIDER, Systema ichthyologiae, p. 315, 1801 (East Indies).—LACEPÈDE, Histoire naturelle des poissons, vol. 4, pp. 340, 380, 1802 (East Indies).—SHAW, General zoology, Pisces, vol. 4, pt. 2, p. 567, 1803 (East Indies).

Serranus horridus (not Cuvier and Valenciennes) CANTOR, Journ. Asiatic Soc. (1849), p. 99, 1850 (Sea of Pinang, Singapore).—GÜNTHER, Catalogue of fishes in the British Museum, vol. 1, p. 136, 1850 (Javanese Sea; Sea of Pinang).

Serranus lanceolatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 3, p. 316 (235), 1828 (Pondicherry).—CANTOR, Catalogue of Malayan fishes, Journ. Asiatic Soc. (1849), p. 990, 1850 (Sea of Pinang).—GÜNTHER, Catalogue of fishes in the British Museum, vol. 1, p. 107, 1859 (Bay of Bengal; Batavia; Samarang).—DAY, Fishes of Malabar, p. 4, pl. 1, fig. 1, 1865 (Malabar).—PLAYFAIR, Fishes of Zanzibar, p. 4, 1866 (Zanzibar).—DAY, Fishes of India, pt. 1, p. 18, pl. 4, fig. 1, 1876 (India).—KÁROLI, Termesz. Füsetek, Budapest, vol. 5, p. 149, 1882 (Singapore; reference

TABLE 136.—*Authentic records of* Promicrops lanceolatus *from the Indo-Pacific*

Authority or author and year	Total length in inches	Length to base of caudal fin in inches	Head length in inches	Weight in pounds	Greatest depth of body in inches	Locality
Boulenger 1895	80					Mauritius
Boulenger 1895	86					Madras
DeVis 1883	84				24	Moreton Bay, Queensland
Ramsey 1881	72		22		16	Near Brisbane, Australia
Ramsey 1881	52			160		Frazer Is., Australia
Ramsey 1881	120?					Frazer Is., Australia
Alcock 1905	89–90			460		Diamond Harbor, River Hooghly, India
Smith, H. M. 1933	74⅕		24			Siam, Estuary Chantabun River
Smith, H. M. 1933	70⁹⁄₁₀	62⅜		475		Siam
Jordan, Evermann, & Tanaka 1927				360		Honolulu
Günther 1869			21			Seychelles
Wëber and de Beaufort 1931	78⅖			about 440		Sengkel, Atjeh
Photo* by Stead	80			413	30	Maclean, Clarence River, Australia
Photograph*	78½	64	22½	337½	25	Eniwetok Atoll
Photograph*	74	63½	25	341½	25	Eniwetok Atoll
Photograph*	81½	70	25½	414	27	Eniwetok Atoll
Photograph*	91			471		Enyu Island, Bikini Atoll

*Photographs in files of division of fishes, U.S. National Museum.

copied).—Macleay, Proc. Linn. Soc. New South Wales, ser. 2, vol. 1, p. 883, 1886 (Cairns, Queensland).—Day, Fauna British India, vol. 1, p. 450, 1889 (India).—Kent, Great Barrier Reef, p. 369, 1896 (Queensland).—Fowler, Proc. Acad. Nat. Sci. Philadelphia, p. 257, 1907 (Sumatra); ibid., p. 223, 1925 (Natal).—Fowler, Mem. Bishop Mus., vol. 10, p. 184, 1928 (Apiang, Gilbert Islands).—Steindachner, Sitzb. Akad. Wiss. Wien, vol. 60, pt. 1, p. 557, 1870 (Singapore).—Devanesen and Chidambaram, The common food-fishes of the Madras state, p. 48, 1953 (Madras).

Promicrops lanceolatus Jordan and Evermann, Proc. U.S. Nat. Mus., vol. 25, p. 342, 1902 (Formosa).—McCulloch, Australian Mus. Mag., Mem. 5, pt. 2, p. 150, 1929 (Australia).—Fowler and Bean, U.S. Nat. Mus. Bull. 100, vol. 10, p. 297, fig. 24, 1930 (Philippines).—Fowler, A list of fishes known from Malaya, Singapore, Fish Bull. No. 1, p. 138, 1938 (Penang; Kuala Selangor, Singapore).—Fowler *in* Gifford, Anthropological Records, vol. 13, No. 3, p. 206, 1951 (Fiji).—Herre, Check List of Philippine fishes, U.S. Fish Wildlife Serv. Res. Rept., No. 20, p. 362, 1953 (Philippines; Singapore).—Fowler, Bernice P. Bishop Mus. Bull. 214, p. 2, 1955 (Fiji).—Munro, The marine and freshwater fishes of Ceylon, Canberra, p. 111, pl. 18, fig. 297, 1955 (Ceylon).

Epinephelus lanceolatus Bleeker, Atlas ichthyologique . . ., vol. 7, p. 49, 1873–1876 (Singapore, Banka, Java, Celebes, Goram); ibid, vol. 8, pl. 332, fig. 3, 1876–77.—Bleeker, Verh. Akad. Wet. Amsterdam, vol. 14, p. 73, 1874.—Boulenger, Catalogue of the fishes in the British Museum, p. 251, 1895 (Port Natal; Mauritius; Zanzibar; Seychelles; Madras; Pinang; Singapore; ?West Africa).—Fowler, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 12, p. 524, 1904 (Padang, Sumatra).—Alcock, Nature, vol. 71, p. 415, 1905, (Diamond Harbor, Hooghly River, India).—Duncker, Naturhist. Mus. Hamburg, Mitteil., vol. 21, p. 147, 198 (1903) 1904 (Kuala Selangor).—Gilchrist and Thompson, Ann. S. African Mus., vol. 6, p. 219, 1908–1910 (Natal Coast).—Thompson, Mar. Biol. Rept. for 1916, No. 3, p. 119, 1916 (South Africa).—Maxwell, Str. Roy. Asiatic Soc. Journ., No. 84, p. 268, 1921 (reference copied).—Barnard, Ann. South African Mus., vol. 21, pl. 2, p. 486, 1927 (Natal Coast).—Jordan, Evermann, and Tanaka, Proc. California Acad. Sci., ser. 4, vol. 16, No. 20, p. 654, 1927 (Honolulu).—Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 70, 1931 (East Indian localities to Hawaii).—Delsman and Hardenberg, De Indische Zeevisschen en Zeevisscherij, Batavia, pp. 211, 213, figs. 154, 155, 1934 (Dutch East Indies).—Cadenat, Rev. Travaux, pp. 381–2, 1935 (doubts occurrence along coast of West Africa).—Blegvad, Fishes of the Iranian Gulf, Danish Scientific Investigation in Iran, pt. 3, pp. 84–85, 1944 (lists *Serranus lanceolatus* as a synonym of *Epinephelus tauvina* and confuses the two species).—Ogilby and Marshall, The commercial fishes and fisheries of Queensland, p. 29, fig. 32, 1954 (Queensland).

Epinephelus lanciolatus Seale, Philippine Journ. Sci., vol. 11, No. 3, sec. D, p. 237, 1916 (Philippines).

Epinephelus tauvina (not Forskål) Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 62, fig. 7, 1931 (Singkel, Atjek).

Oligorus terrae-reginae Ramsey, Proc. Linn. Soc. New South Wales, vol. 5, p. 93, 1881 (type locality, Queensland).

Oligorus goliath De Vis, Proc. Linn. Soc. New South Wales, vol. 7, p. 318, 1883 (type locality, mouth of Fitzroy River, Queensland).

Serranus geographicus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 2, p. 322 (240), 1828 (type locality, Java).—Günther, Catalogue of the fishes in the British Museum, vol. 1, p. 150, 1859 (Java).

Batrachus gigas Günther, Ann. Mag. Nat. Hist., ser. 4, vol. 3, p. 131, 1869 (Seychelles).

Promicrops itaiara Stead, Fishes of Australia, pp. 96, 103, 1906 (Queensland).—Stead, The edible fishes of New South Wales, p. 58, pl. 28, 1908 (mouth of Richmond and Clarence Rivers, Northern Australia).—Smith, Journ. Siam Soc., Natural History Supplement, vol. 9, No. 1, p. 85, 1933 (Siam).

SPECIMENS STUDIED

Photographs of a specimen caught Jan. 2, 1955, Eniwetok Atoll, total length 74 inches, weight 341½ pounds.

Photographs of a specimen caught Aug. 10, 1955, off Parry Island, Eniwetok Atoll, depth 20 to 35 feet, on hook and line by Masonori Nishi, total length 78½ inches, weight 337½ pounds.

Photographs of a specimen caught Aug. 20, 1955, at Eniwetok Atoll, by Lowell Kupau by hook and line, total length 81½ inches, weight 414 pounds.

Photograph of a specimen caught Feb. 26, 1956, at Enyu Island, Bikini Atoll, by Robert Schook and Pitts Joyner. About this large specimen Dr. Robert Hiatt writes: "This fish weighed 471 lbs. and had a total length of 7 ft. 7 inches. It was taken on a specially forged hook and airplane cable leader tied to a 800 lb. test nylon line. It is the largest of this species taken in the Marshalls insofar as is known. When caught it had a veritable nest of lines and hooks in its mouth." This specimen is only 4 lbs. lighter than the world record size.

Description.—Detailed measurements of these specimens are recorded in table 138 and counts in table 137.

Remarks.—In order to identify with confidence the giant sea basses caught at Eniwetok, I made detailed measurements and counts on the specimens available in the national collections. It was found that the *Promicrops* of the western Atlantic was closely related to that of the Indo-Pacific. No direct comparison of these two species had been made, and it was possible that they were identical. However, my studies revealed that *P. lanceolatus* and *P. itaiara* are strikingly different in color pattern when very small and in the immature stage as illustrated in plates 147 and 148. Certain counts recorded in table 138 indicate differences between the two species. The best such characters are pectoral and soft dorsal rays.

H. M. Smith (Nat. Geog. Mag. 637–644, May 1909) published a popular article on "Some Giant Fishes of the Seas." On page 639 he states there are 3 species of sea bass or jew-fishes that rank among the largest spiny finned fishes. Smith says the spotted jew-fish (*Promicrops itaiara*) of the West Indies reaches 600 pounds; the black jew-fish (*Garrupa nigrita*) 500 pounds, and the California jew-fish (*Stereolepis gigas*) 600 pounds. Since Dr. Smith does not cite actual catch records for these large sizes, we must cast doubt on the authenticity of them. However, Smith (Mid-Pacific Mag., vol. 29, No. 3,

TABLE 137.—*Counts recorded for species in genus* Promicrops

Species	Number of vertical scale rows above lateral line																Number of scales from lateral line to									
																	Base of last dorsal spine			Midventral line in front of anus						
	92 93	94 95	96 97	98 99	100 101	102 103	104 105	106 107	108 109	110 111	112 113	114 115	116 117	118 119	12	13	14	30	31	32	33	34	35	36	37	38
itaiara					1	1	3	2	3	2	1	1		1		6	9	1	1	4	2	2	4	1		
lanceolatus	1	2		2	1			2	1						2	3	3			3		2	1	1		1

Species	Number of pores in lateral line									Character index: soft dorsal, branched pectoral rays on both fins, and total gill rakers totaled for each specimen									
	56	57	58	59	60	61	62	63	72	73	74	75	76	77	78	79			
itaiara	2	1	4	2				4				2	5	4	3		1		
lanceolatus	2	1	1	2	1	2			1	1	3	2							

p. 594, 1925) illustrates a 7½ foot long "drum fish" that is *P. lanceolatus*.

Dr. A. Seale sent a photograph of *P. lanceolatus* to the U.S. National Museum, on the back of which he wrote: "Weight 306 lb., length 7 ft. 3 in., caught near Carabow Is. in entrance to Manila Bay." This is now in the division of fishes files.

Boulenger (Proc. Zool. Soc. London 1897, pp. 917–918, pl. 52) reported on two giant sea-perch of the Pacific. He synonymized *Megaperca ischinagi* Hilgendorf from Japan with *Stereolepis gigas* Ayers from California. His California specimen measured 1.4 meters or 55⅛ inches in total length. Boulenger (Ann. Mag. Nat. Hist., ser. 7, vol. 19, pp. 489–491, 1909) verifies still further his proposal that there is only one species of *S. gigas*.

TABLE 138.—*Measurements of three specimens of* Promicrops lanceolatus *from Eniwetok recorded in thousandths of lengths*

	Standard lengths			Total lengths		
Total length (T.L.) in mm.				1,994	1,880	2,070
Standard length (S.L.) in mm.	1,626	1,613	1,778			
Length of head	352	394	364	287	338	313
Greatest depth of body	385	393	386	319	338	331
Snout	85	79	93	70	63	80
Snout tip to lower preopercular angle	231	268	264	190	230	227
Eye	29	31	25	24	27	22
Least width of interorbital	104	102	100	86	88	86
Length of maxillary bone	185	189	164	153	162	141
Greatest width of maxillary bone	45		45	38		39
Length of maxillaries	227			185		
Tip of lower jaw to anus	724		779	589		668
Greatest depth of head	262		322	217		276
Least depth of caudal peduncle	131	126	125	108	108	108
Length of caudal peduncle	172	142		140	122	
Postorbital length of head	289	236		236	203	
Longest pectoral ray	224	189	157	185	162	135
Longest pelvic ray	170		150	140		129
Longest soft anal ray	139		136	115		117
Longest anal (III) spine	62		50	51		43
Longest soft dorsal ray	123		121	102		104
Longest dorsal (VIII) spine	69		57	57		49

Jordan and Richardson (Proc. U.S. Nat. Mus., vol. 37, pp. 435–437, figs. 4, 5, 1910) reinforce the claim of Jordan and Snyder (Proc. U.S. Nat. Mus., vol. 30, p. 841, fig. 1, 1906) that the two species are distinct. The final answer to the problem has not been given because of a lack of specimens from both sides of the Pacific.

World Record Marine Game Fishes 1955 by International Game Fish Association lists the largest specimen of *Sterolepis gigas* that I have observed in the literature. Eighty-seven inches in total length and weighing 483 pounds, it was taken off Coronado Island, Mexico, by R. E. De Groff. They do not list *Promicrops lanceolatus*, but their

TABLE 139.—*Measurements of two species of* Promicrops *expressed in thousandths of standard length and arranged according to size*

Standard length in mm.	*itaiara*															*lanceolatus*										
	405	395	375	360*	350	335*	315	310*	250	240	235	225	215	175	90	1778	1626	1613	1165	330	270	208	195	150	120
Head	425	405	395	420	414	424	420	402	408	404	421	422	390	412	420	364	352	394	420	428	419	428	405	414	408
Depth	341	339	333	320	343	325	340	319	324	313	328	351	335	352	345	386	385	393	326	328	322	327	338	360	325
Length maxillaries	190	197	192	192	194	197	197	187	196	192	196	209	181	186	217	-----	227	-----	193	197	189	197	190	193	196
Length third dorsal spine	101	91	88	94	94	96	98	103	96	117	115	116	98	109	139	-----	-----	-----	116	97	89	101	113	120	114
Least depth caudal peduncle	131	139	131	134	131	149	114	135	132	129	128	133	135	126	128	125	131	126	133	130	130	130	133	133	121
Length caudal peduncle between vertical lines through rear basal edge of dorsal and anal fins	148	177	163	145	157	143	149	152	172	154	153	171	140	146	139	142	172	-----	137	152	148	144	154	160	154
Width of fleshy interorbital space	86	91	80	83	89	90	81	77	92	79	72	91	74	71	72	100	104	102	77	94	85	82	82	87	79
Diameter of eye	57	46	47	46	49	45	53	44	52	54	52	50	53	57	78	25	29	31	69	52	50	58	51	57	67

*Eastern Pacific.

record size for *P. itaiara* of 551 pounds and a length of 100 inches, caught in Galveston Bay, Texas, by G. Pangarakis, exceeds all other verified size records for all species of sea bass as far as I can find.

George C. Miller of the U.S. Fish and Wildlife Service photographed a large specimen of *Promicrops* (probably *P. itaiara*) that was caught by A. K. Freeman off the Loffa River, Liberia, December 1953. This large sea bass had its rear third or more bitten off (presumably by a big shark), but the anterior portion when landed weighed 293 pounds and still was about 4½ or 5 feet long. Photographs of this specimen are in the files of the division of fishes.

Family PSEUDOCHROMIDAE

Volume 1, page 398

Robert F. Inger (Pacific Sci., vol. 9, no. 3, pp. 259–276, figs. 1–4, 1955) revised the genus *Plesiops*. This careful study requires corrections to be made in regard to my tentative identifications made on pages 398–400.

P. nigricans Rüppell is confined to the Red Sea, and as far as it is known, it has never been collected elsewhere. The specimens reported by me as *P. nigricans* are now identified as *P. corallicola* Bleeker (Nat. Tijdschr. Nederl-Indië, vol. 4, p. 280, 1853; type locality, Priamam, Sumatra).

Those identified by me as *P. melas* on page 400 are now identified as *P. coeruleolineatus* Rüppell (Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische, p. 5, pl. 2, fig. 5, 1835; type locality, Red Sea). *P. melas* Bleeker is a synonym.

Family CARANGIDAE

Volume 1, page 509

To specimens studied under *Trachinotus bailloni*, add 1 specimen, 22.5 mm., Agfayan Point, Guam, collected by M. H. Markley, July 7, 1945.

To the genus *Trachinotus* add:

TRACHINOTUS BLOCHII (Lacepède)

Caesiomorus blochii LACEPÈDE, Histoire naturelle des poissons, vol. 3, p. 95, pl. 3, middle figure, 1802 (no locality given).

SPECIMENS STUDIED

Guam: Bijia Point, June 22, 1945, McElroy and Markley, 3 specimens, 34 to 36 mm.

Description.—Dorsal rays VII,I,18 in two, VII,I,19 in one; anal II,I,16 in three; pectoral I,i,16 in six; scales forming, not countable; gill rakers 5+1+10 in one. Depth 1.9 to 2.0; head 2.5 to 2.6; both

in standard length. Snout 3.7 to 4.0; eye 3.3 to 3.6; upper jaw 2.7 to 2.8; interorbital width 2.6 to 2.8; postorbital length 2.1; length of pectoral fin 1.7 to 1.8; of pelvic fin 2.0 to 2.2; longest dorsal ray 1.5 to 1.6; longest anal ray 1.7 to 1.8; length of upper caudal lobe 1.2 to 1.3; of lower caudal lobe 1.2; all in length of head.

Color in Alcohol.—Light grayish dorsally, whitish ventrally; first few rays of soft dorsal dusky, anterior edge of anal dusky, rest of fins pale.

Remarks.—This species is distinguished from *T. bailloni* by the fewer rays in both dorsal and anal fins. *T. blochii* has VII,I,18 or 19 dorsal rays instead of VI,I,22 to 25; and anal rays are II–I,16 instead of II–I,21 to 23.

Volume 1, page 518

To *Carangoides ferdau jordani*, add 7 specimens, 13.5 to 31 mm., collected by the University of Washington on July 26, 1946, between Amen and Bikini islands.

Dr. Welander stated that "these fish were picked up with a small hand dip net in the area about halfway between Amen Island and Bikini Islands. The small fish were swimming along with the jellyfish and remaining in the immediate vicinity of their tentacles. Each jellyfish seen seemed to have one and occasionally more than one small fish in its company."

This is the first record I have noticed of the association of the young of this species living in association with a jellyfish. The latter was identified by Dr. F. M. Bayer as a Scyphozoan, genus *Mastigias* Agassiz. It bears USNM 50085 in the division of marine invertebrates of the U.S. National Museum.

Volume 1, page 520

Genus GNATHANODON Bleeker

Gnathanodon Bleeker, Nederl. Tijdschr. Dierk., vol. 1, p. 160, 1850; ibid. vol. 1, p. 352, 1851 (type species, *Scomber speciosus* Forskål).

GNATHANODON SPECIOSUS Forskål

Scomber speciosus Forskål, Descriptiones animalium, p. 54, 1775 (type locality, Red Sea).

SPECIMEN STUDIED

Arno Atoll: Marshall Islands, July 22, 1950, caught in dredge at 120 feet, Strasburg and Hiatt, 1 specimen, 25 mm.

Description.—Dorsal rays VII–I,20; anal II–I,17; pectoral I,i,19; branched caudal rays 8+7, gill rakers 3+1+19.

Color in Alcohol.—Background coloration light brown, sides with 4 vertical brownish bars slightly narrower than paler brown interspaces;

a dark brown V-shaped bar on posterodorsal part of head, this bar beginning on dorsal edge of eye and meeting its fellow at occiput.

Family LUTJANIDAE

Volume 1, page 537

Add the following specimen to *Montaxis grandoculus* (Forskål)—Eniwetok Atoll: Northwest Passage near Rigili Island, May 25, 1946, S–46–184, Schultz and Cali, 3 specimens, 22 to 29 mm. in standard length.

Family LEIOGNATHIDAE

Volume 1, page 556

Genus LEIOGNATHUS

Leiognathus Lacepède, Histore naturelle des poissons, vol. 4, p. 448, 1803 (type species, *Leiognathus argenteus* Lacepède).

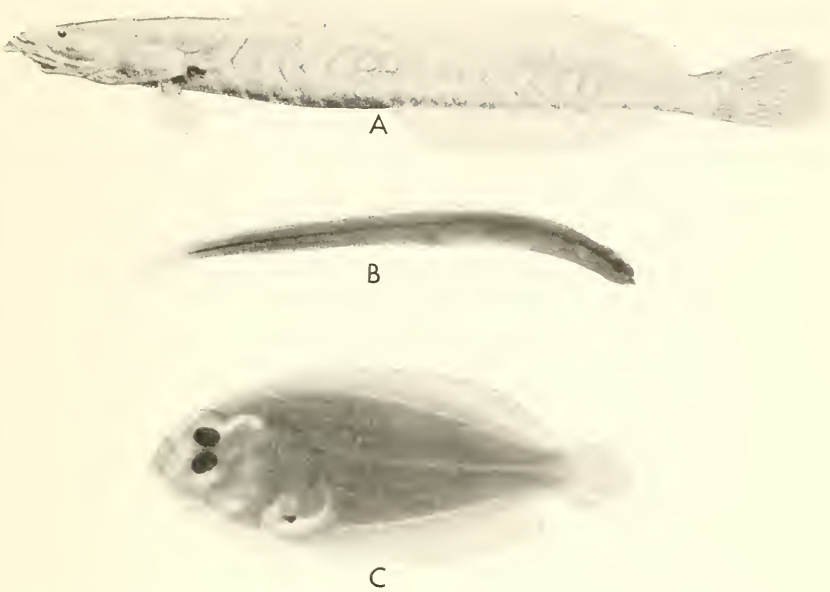
LEIOGNATHUS EQUULUS (Forskål)

Scomber equula Forskål, Descriptiones animalium, p. 58, 1775 (type locality, Arabia).

SPECIMEN STUDIED

Guam: Agfayan Bay, June 14, 1945, McElroy and Markley, 1 specimen, 17 mm.

Description.—Dorsal rays VIII,16; anal III,14. This small specimen, has a pair of spines at front dorsal part of eye, followed by a ridge that extends to the tip of the nuchal spine; second dorsal and second anal spine very strong, longer than other spines; mouth almost horizontal; lower edge of preopercle serrate.



A, *Kraemeria bryani* Schultz; B, *Gunnellichthys pleurotaenia* Bleeker; C, *Arnoglossus intermedius* (Bleeker).

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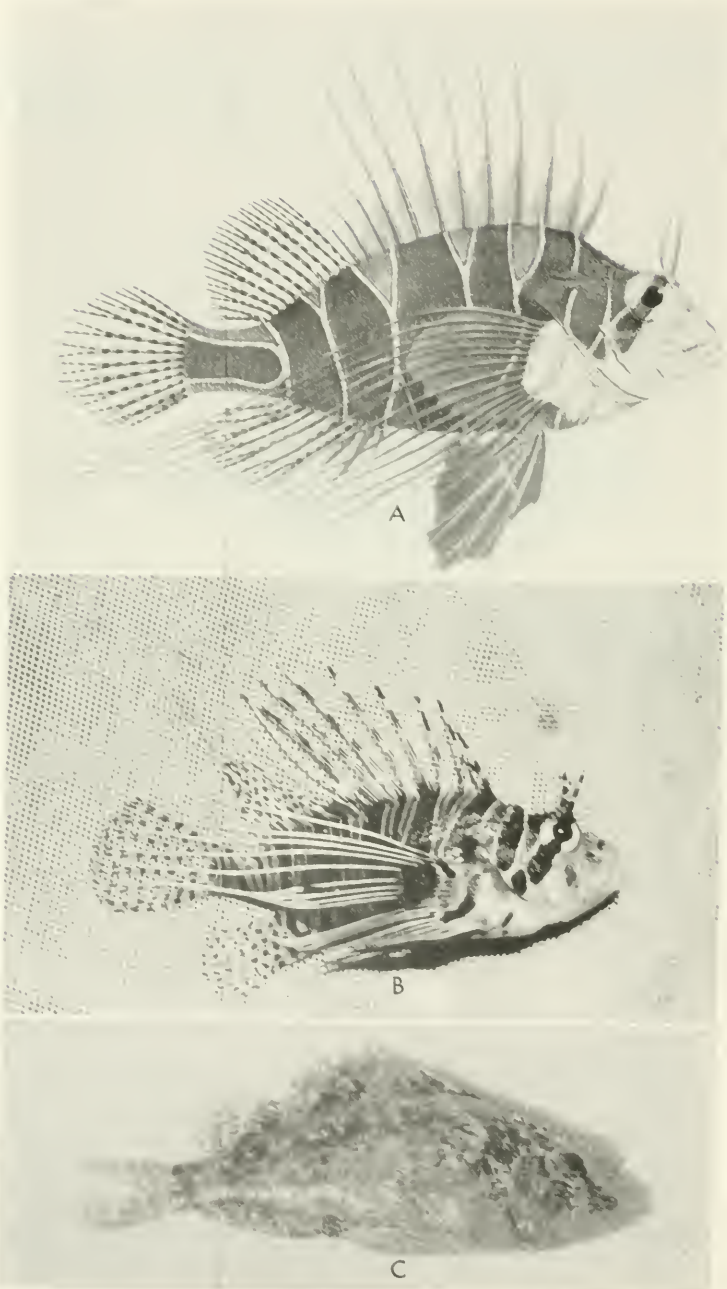
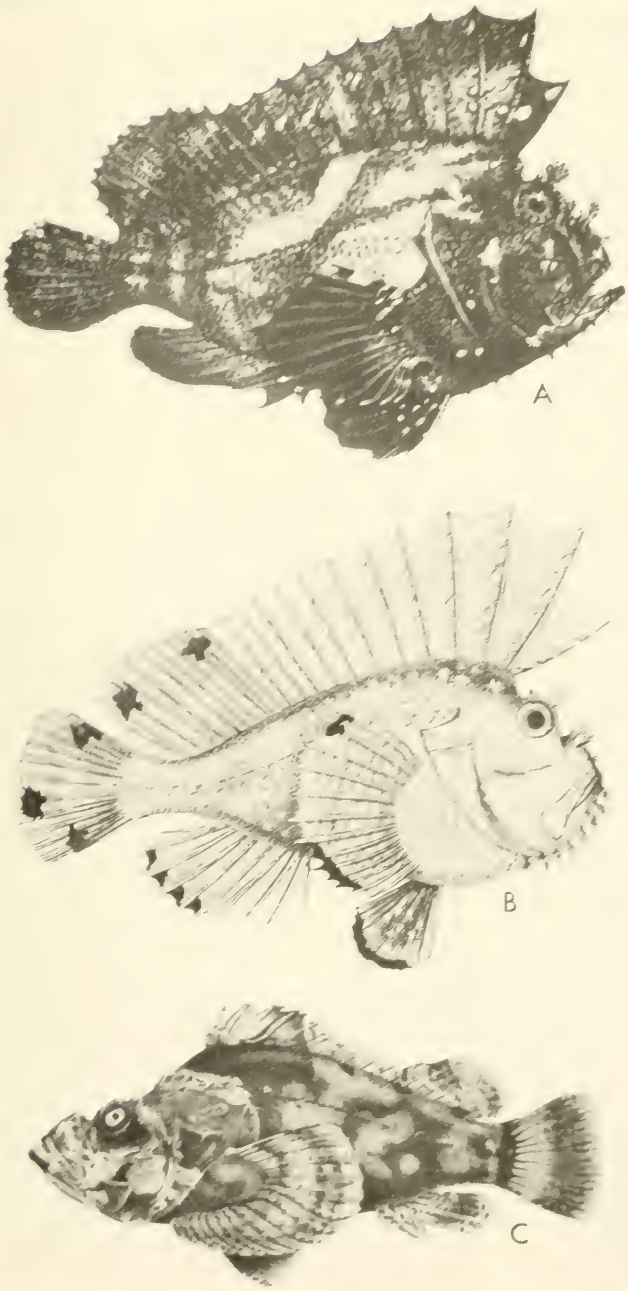
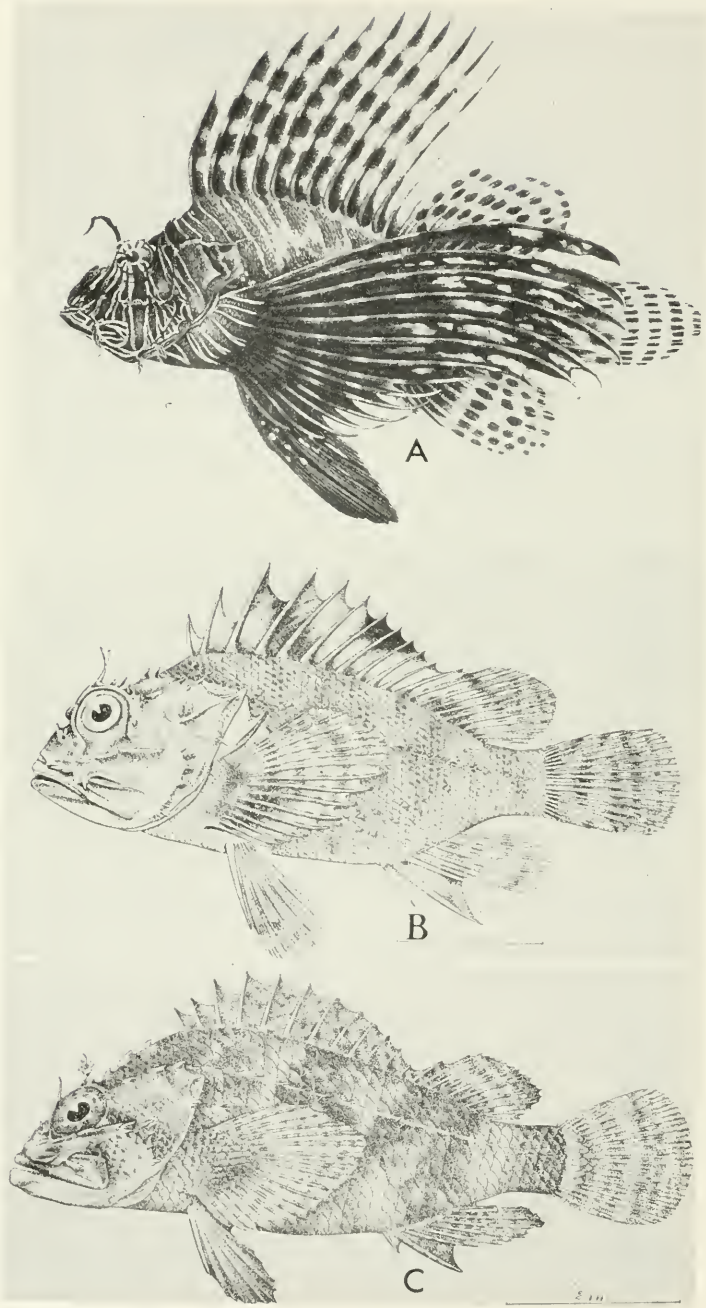


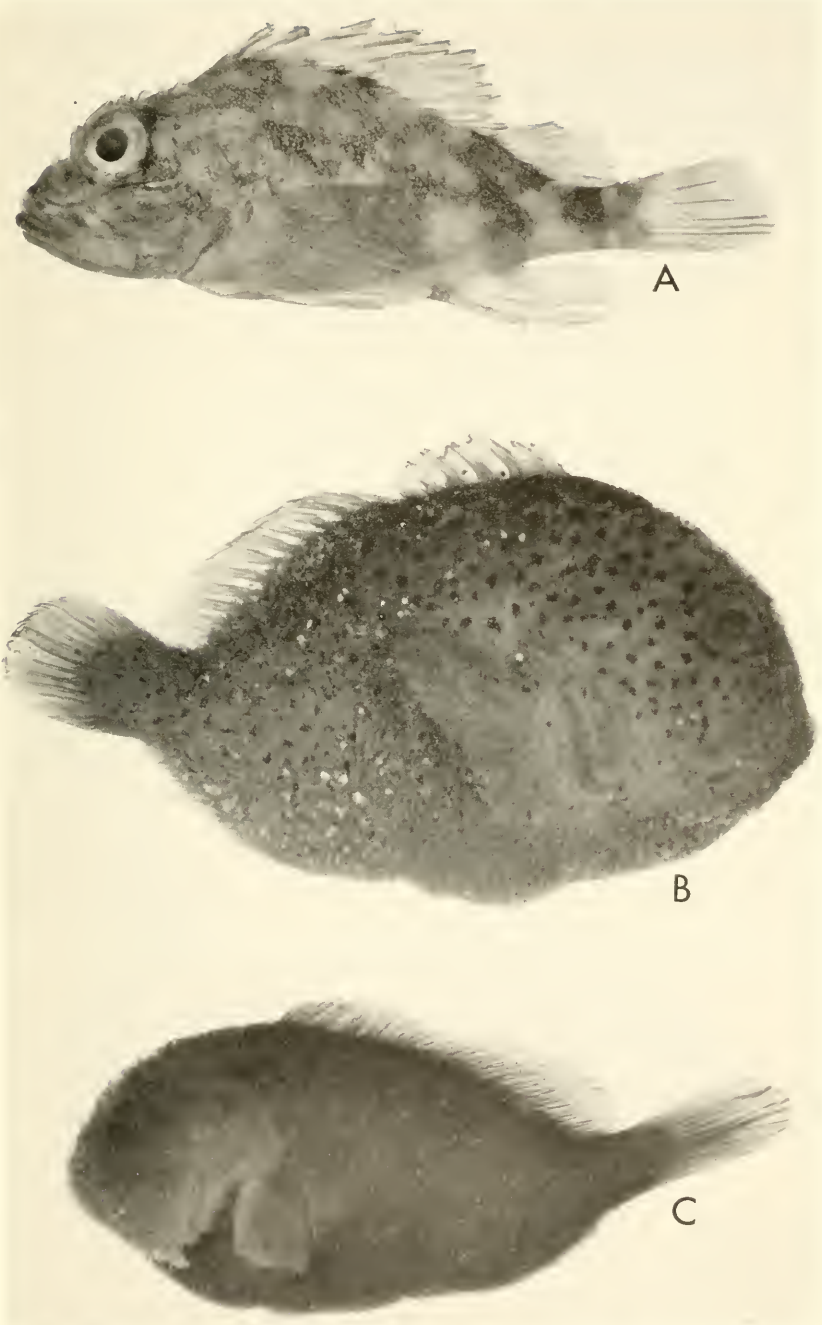
A, *Pterois radiata* Cuvier and Valenciennes, after Günther; B, *P. antennata* (Bloch); C, *Scorpaenodes guamensis* (Quoy and Gaimard); B, C, photographs of Kodachromes taken at Bikini.



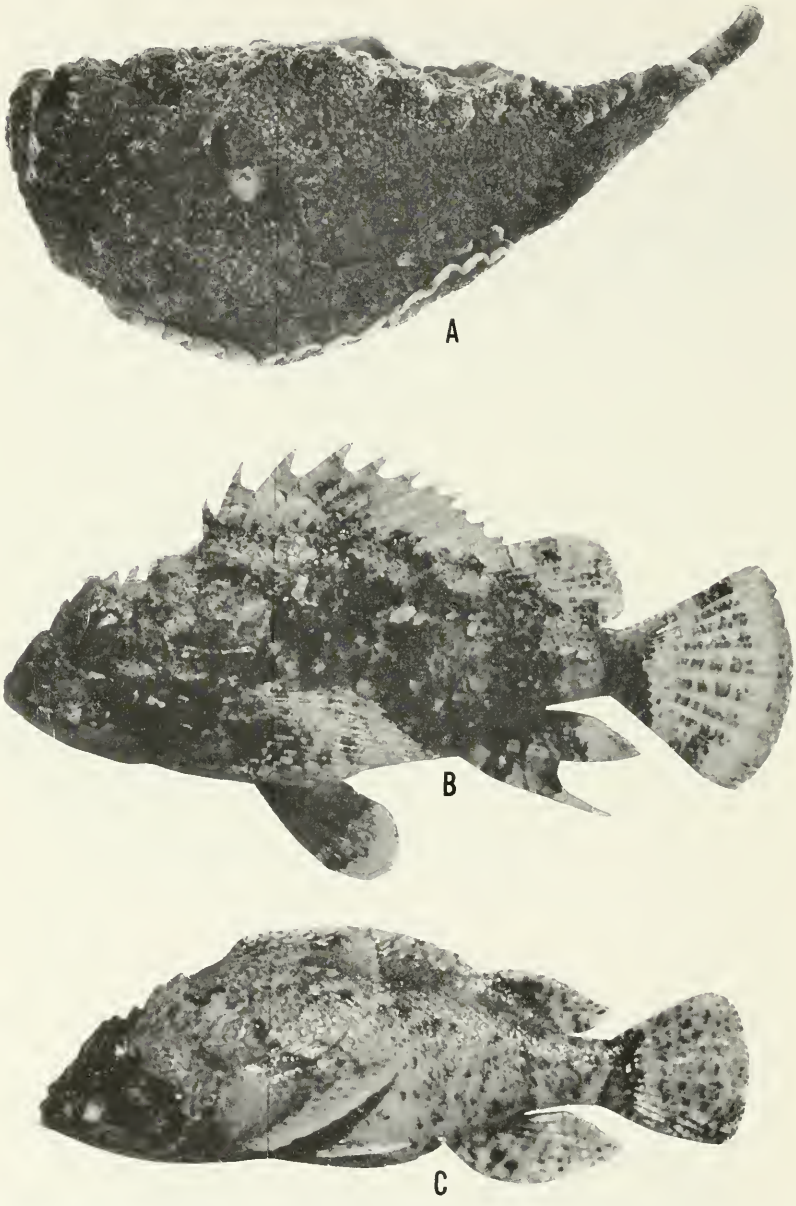
A, B, *Taenianotus triacanthus* Lacepède, after Günther; C, *Scorpaenopsis venosa* (Bloch and Schneider), after Günther.



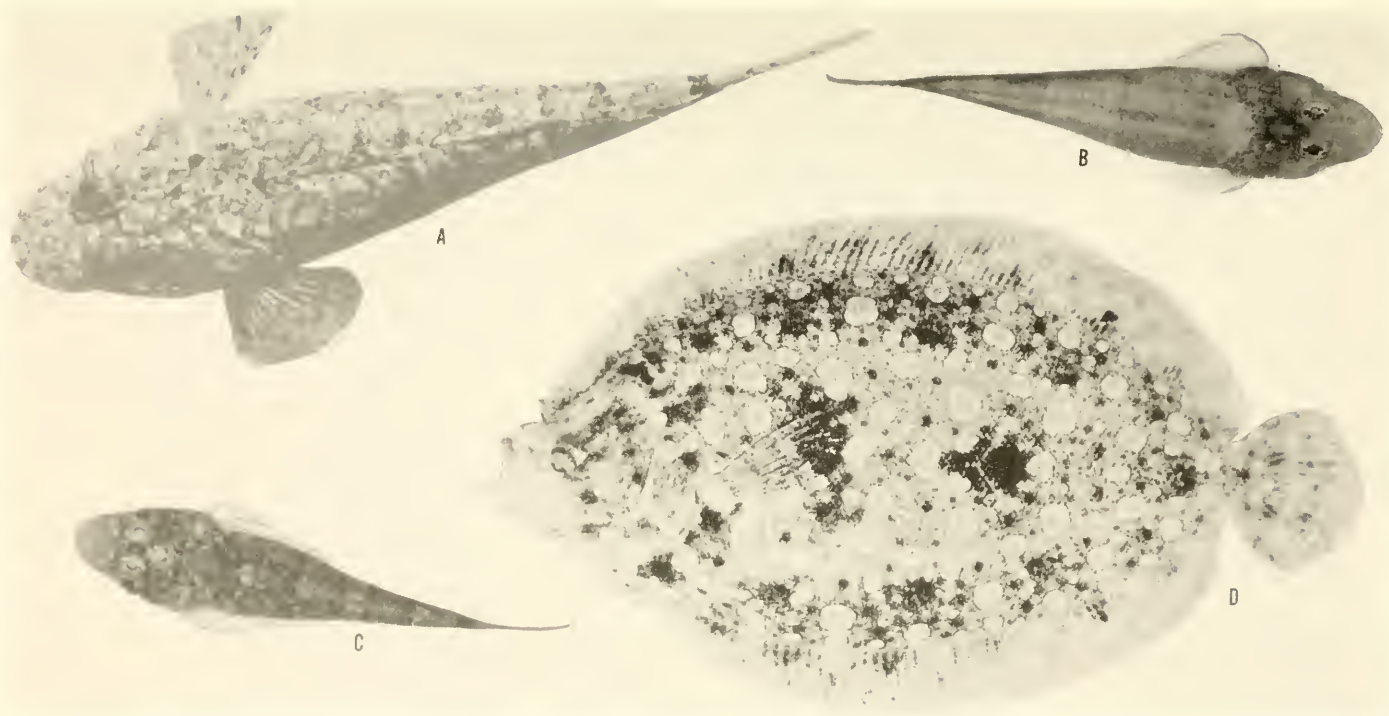
A, *Pterois volitans* (Linnaeus), after Jordan and Seale; B, *Sebastapistes corallicola* Jenkins, after Jordan and Evermann; C, *Scorpaenodes kelloggi* (Jenkins), after Jordan and Evermann.



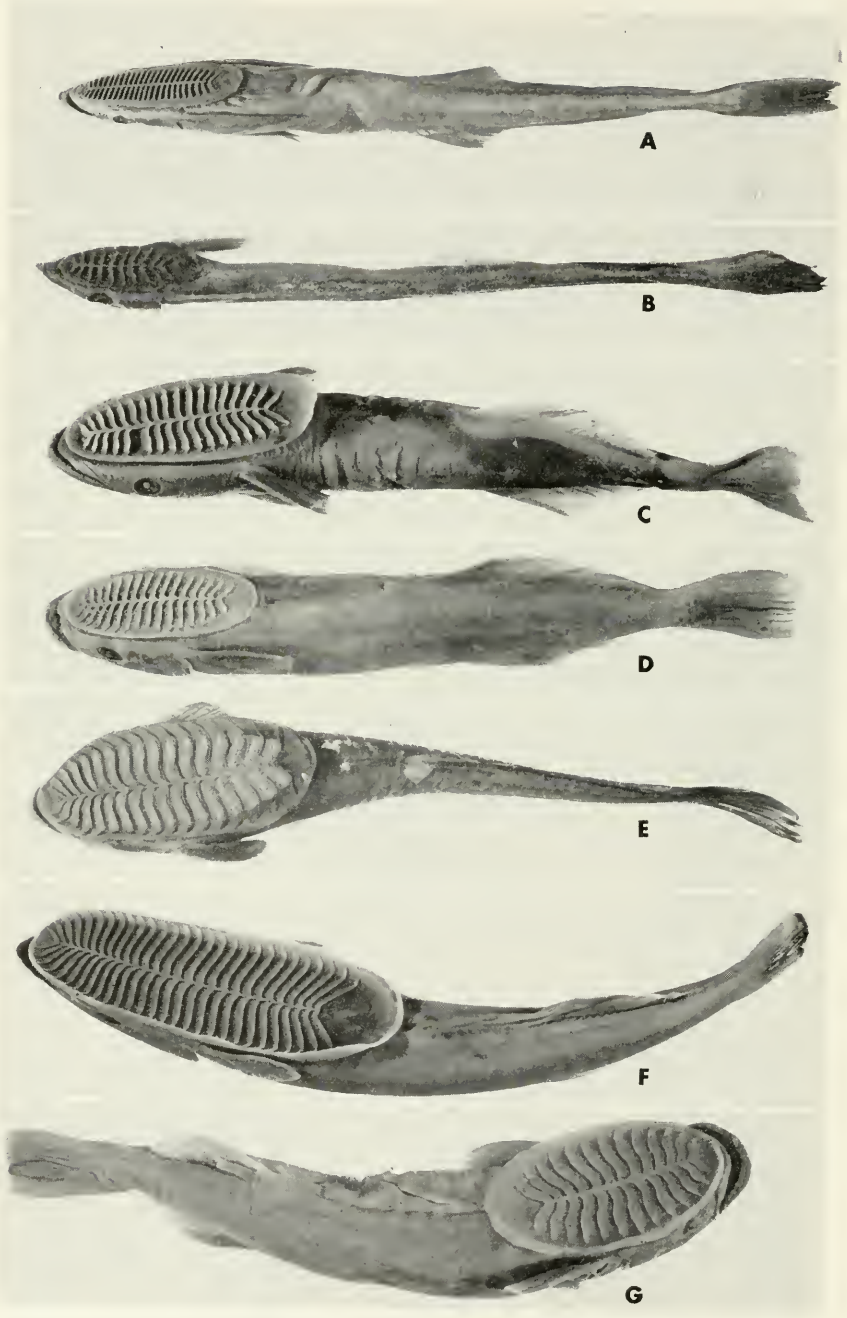
A, *Sebastapistes albobrunnea* (Günther), USNM 140215, from Bikini Atoll; B, *Caracanthus maculatus* (Gray), USNM 140990. from Bikini Atoll; C, *C. unipinnus* (Gray), USNM 140996.



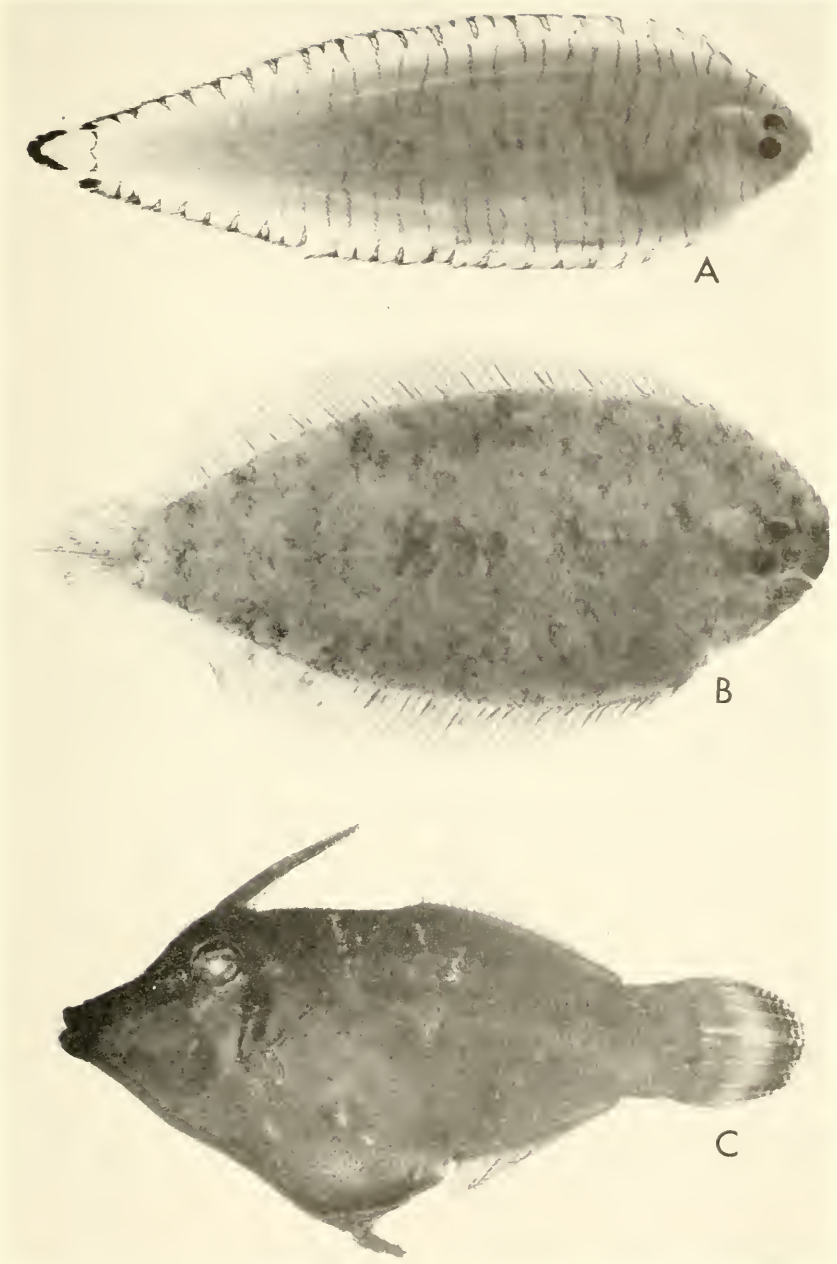
A, *Syanceia verucosa* Bloch and Schneider, USNM 115734, from Tutuila Island, Samoa; B, *Sebastapistes mcadamsi* (Fowler), photograph from a Bikini Kodachrome; C, *Scorpaenodes parvipinnis* (Garrett), photograph of a Kodachrome taken at Bikini.



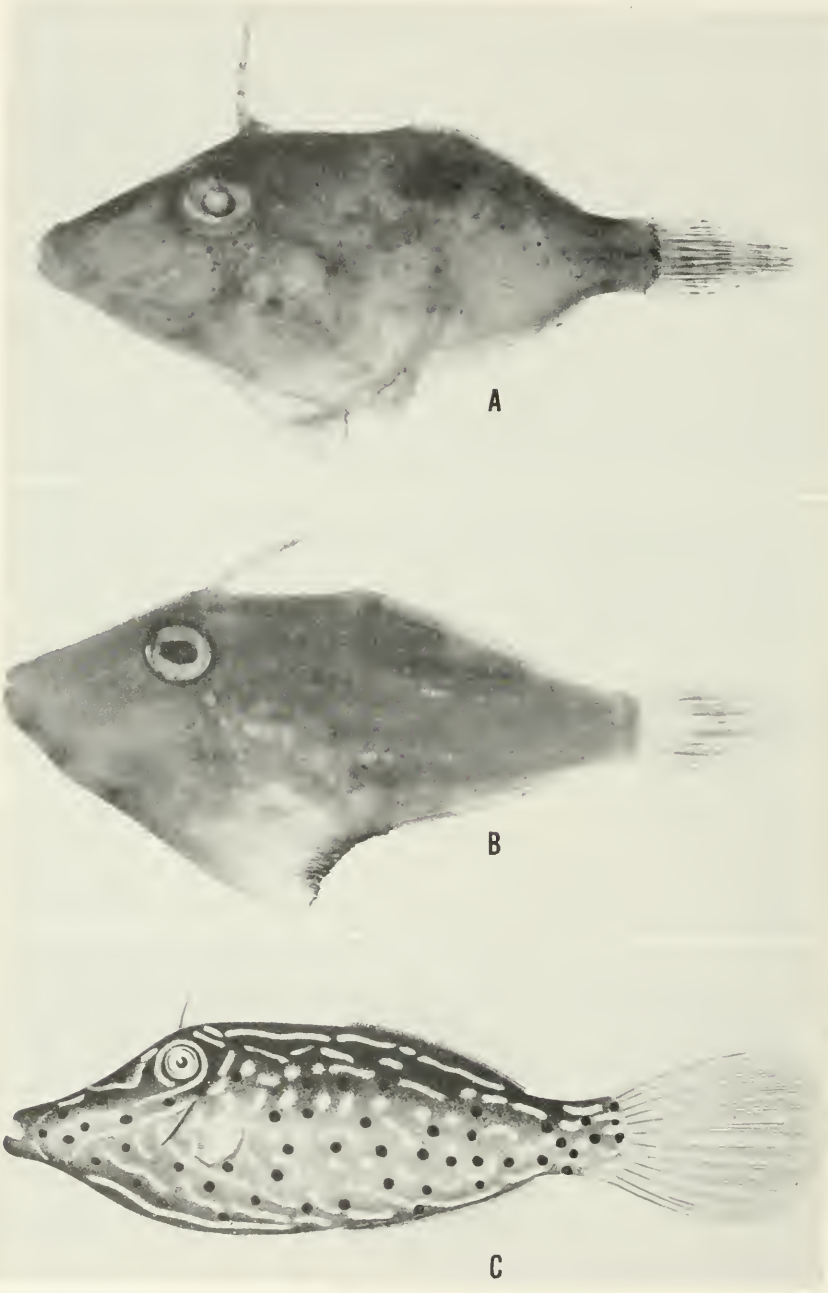
A, *Thysanophrys papillolabium*, new species, photograph of holotype USNM 141004, from Bikini Atoll; B, C, *T. arenicola*, new species, B, holotype USNM 141007, from Rongelap Atoll, C, paratype USNM 112393, from Rongerik Atoll; D, *Bothus mancus* (Broussonet), photograph from a Bikini Kodachrome.



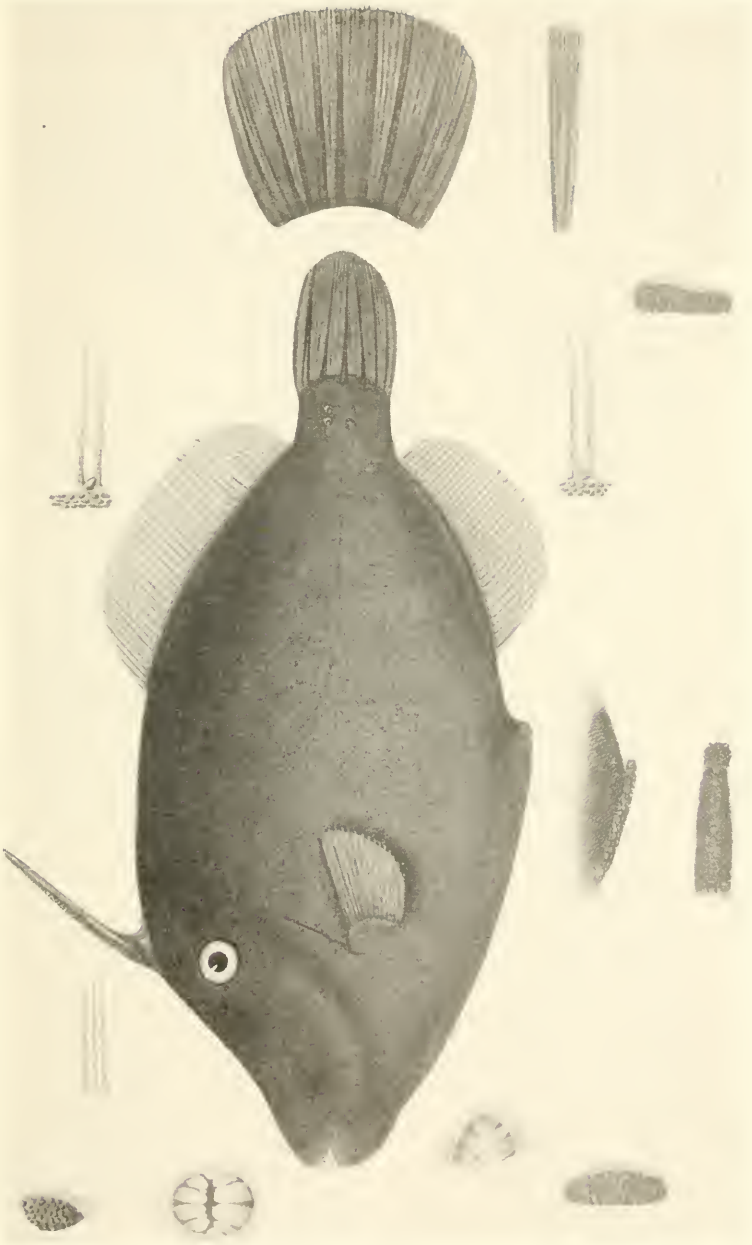
A, *Echeneis naucrates* Linnaeus, USNM 152123, 544 mm. in standard length, from Guam; B, *Phtheirichthys lineatus* (Menzies), USNM 149972, 125 mm., off coast of Georgia; C, *Remora remora* (Linnaeus), USNM 83809, 129 mm., from Atlantic City, New Jersey; D, *Remora brachyptera* (Lowe), CNHM 41291, 136 mm., from the Galapagos Is.; E, *Remora osteochir* (Cuvier), USNM 153581, 204 mm., from Cuba; F, *Remora australis* (Bennett), UMMZ 164784, 149 mm., from Japan; G, *Remorina albescens* (Temminck and Schlegel), UMMZ 164785, 159 mm., from Japan.



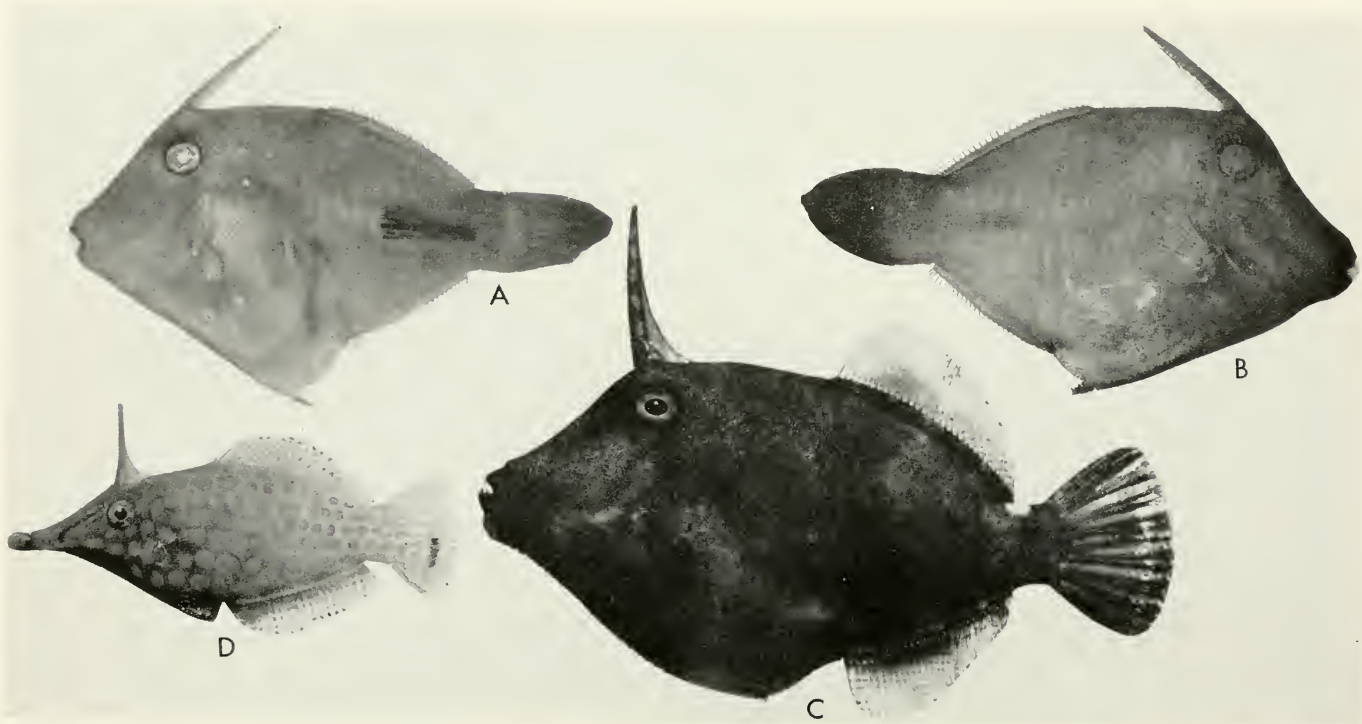
A, *Aesopia heterorhinos* (Bleeker), USNM 141794, from Rongelap Atoll; B, *Aseraggodes melanostictus* (Peters), USNM 141788, from Kwajalein Atoll; C, *Pervagor melanocephalus melanocephalus* Bleeker, USNM 145382.



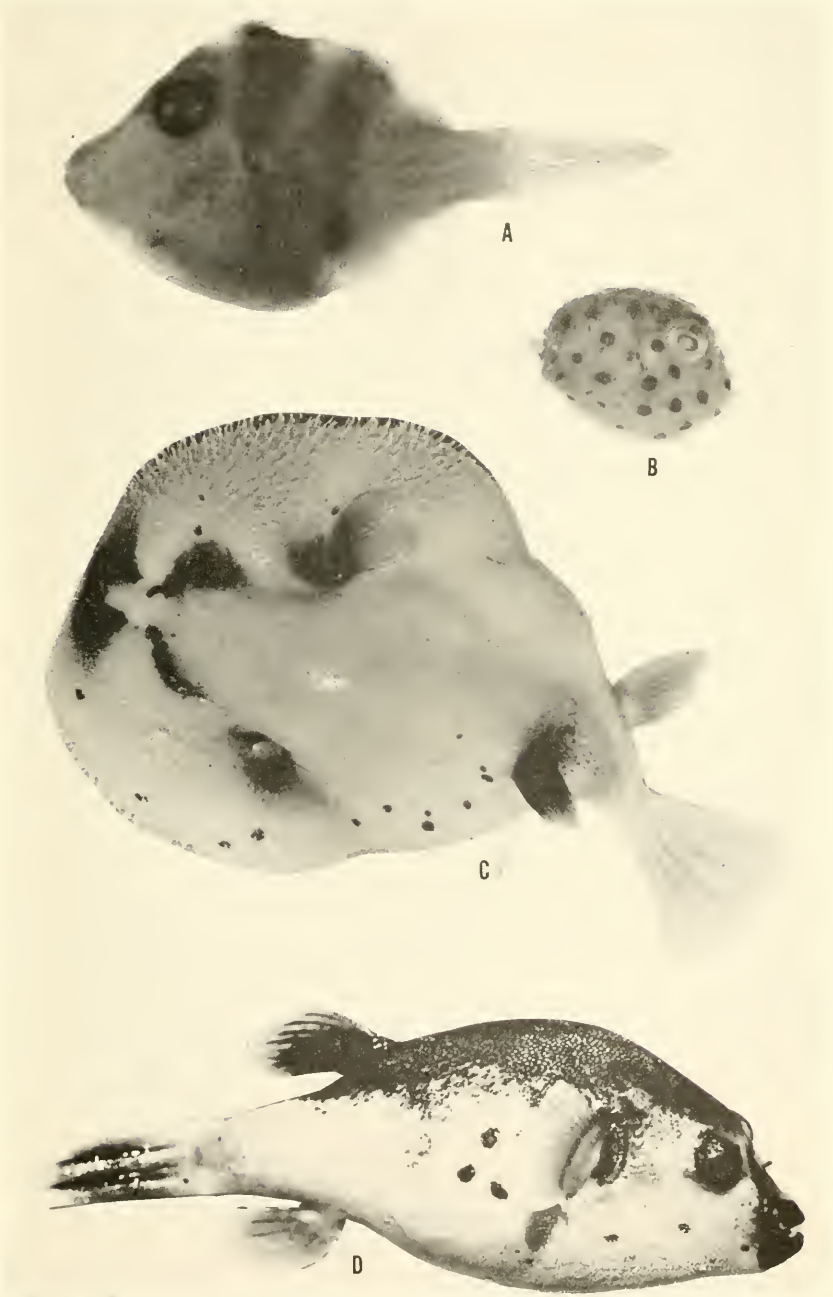
A, *Paramonacanthus cryptodon* (Bleeker), USNM 140641, from Bikini Atoll; B, *Paramonacanthus oblongus* (Schlegel), USNM 140642, from Rongelap Atoll; C, *Alutera scripta* (Osbeck), after Bleeker.



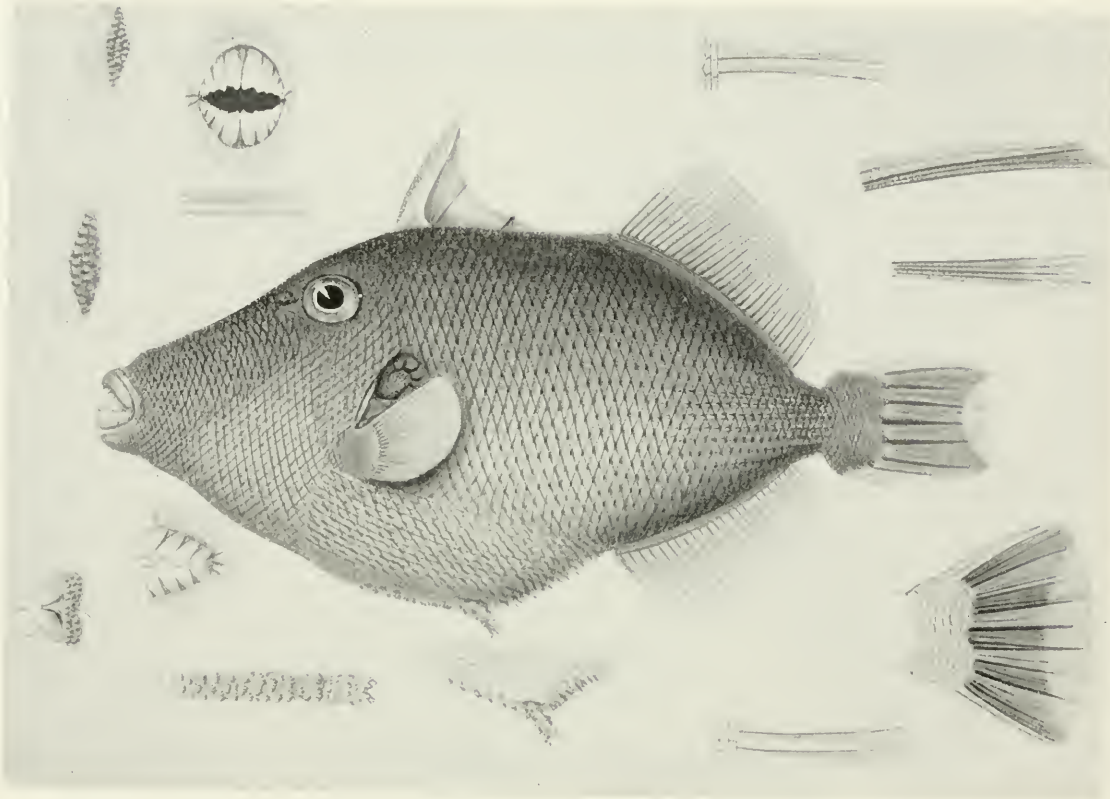
Amanses carolae (Jordan and McGregor), a drawing by T. H. Richard from a Tahiti specimen.



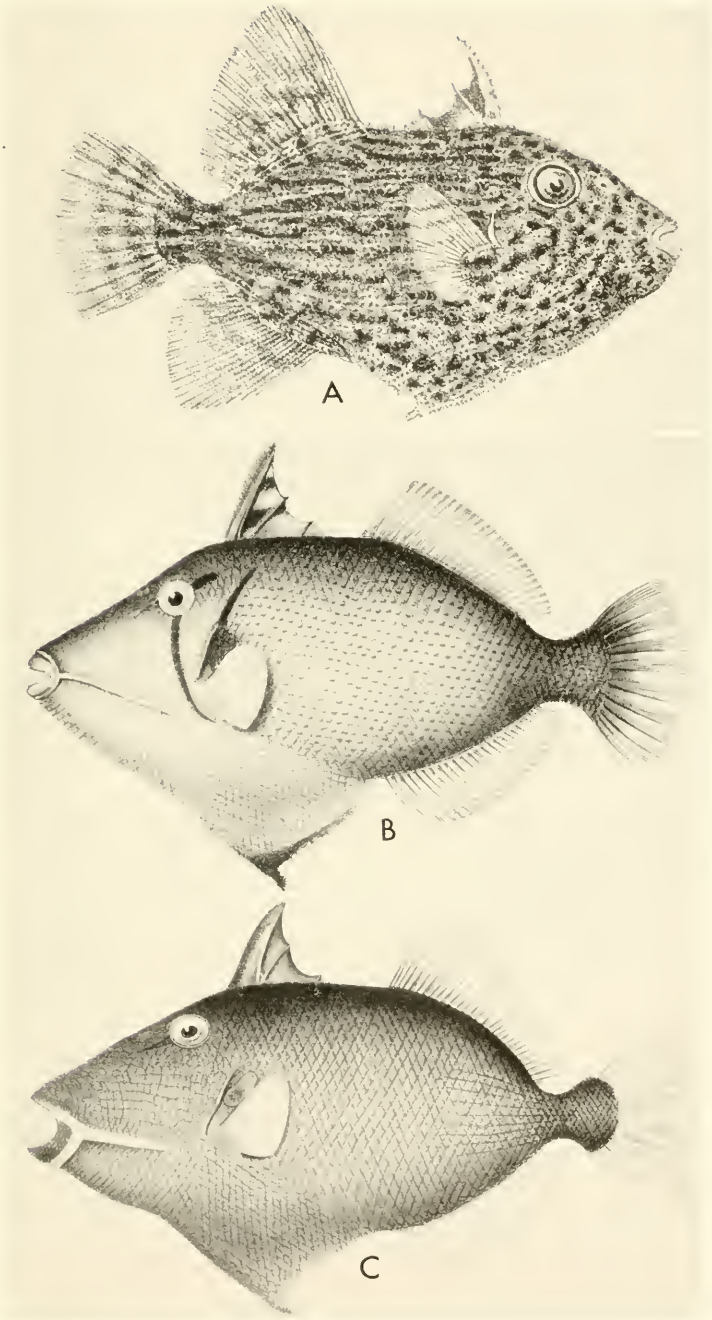
A, B, *Amanses scopas* (Cuvier), A, male, USNM 145450, from Tidore Island, East Indies, B, female, USNM 140644, from northern Marshall Islands; C, *A. sandwichensis* (Quoy and Gaimard), photograph from a Bikini Kodachrome; D, *Oxymonacanthus longirostris* (Bloch and Schneider), from a Bikini Kodachrome. Note that on C and D, the bobbinetting on which the fish were laid when photographed shows through the fins.



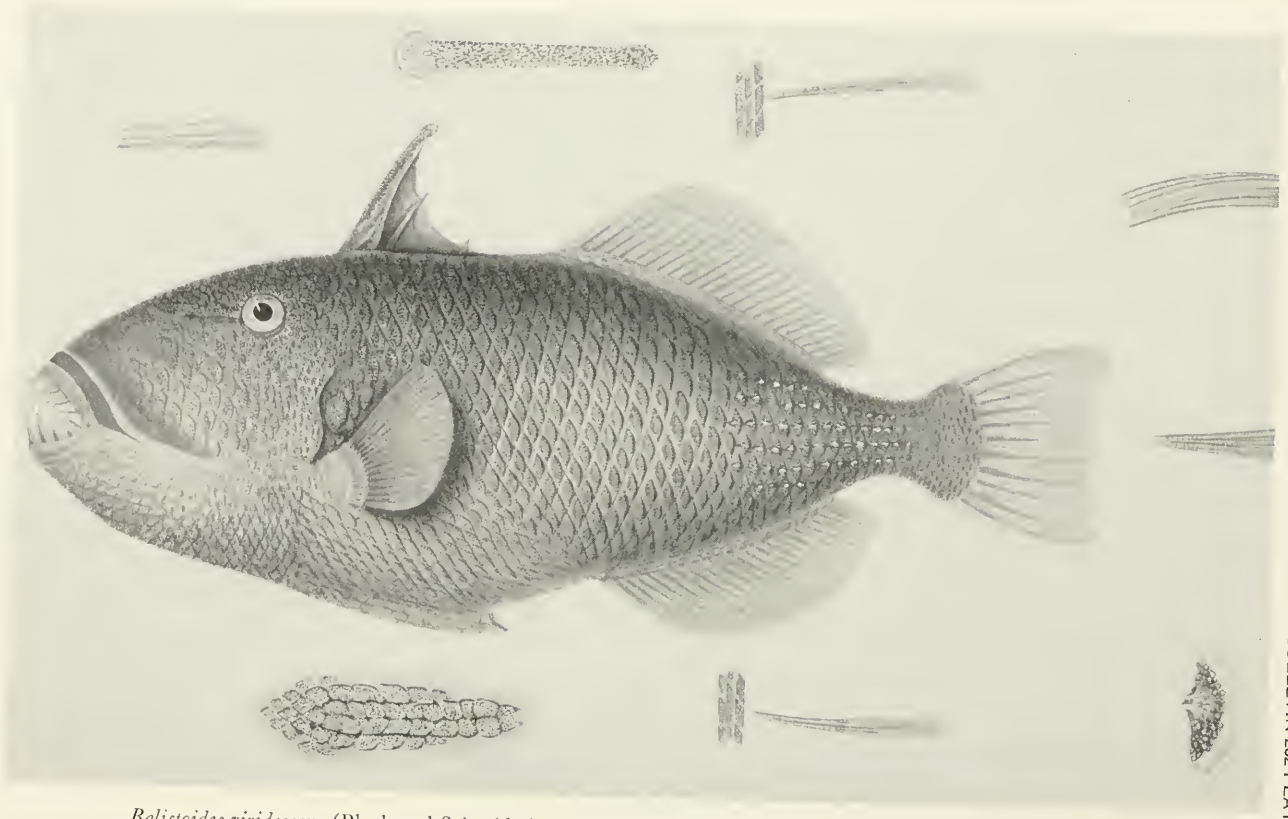
A, *Paraluteres prionurus* (Bleeker), USNM 140646, from Bikini Atoll; B, *Ostracion cubicus* (Linnaeus), photograph of a small young specimen, USNM 140388, from Eniwetok Atoll; C, D, *Arothron nigropunctatus* (Bloch and Schneider); A, B, C, photographs from Kodachromes taken at Bikini.



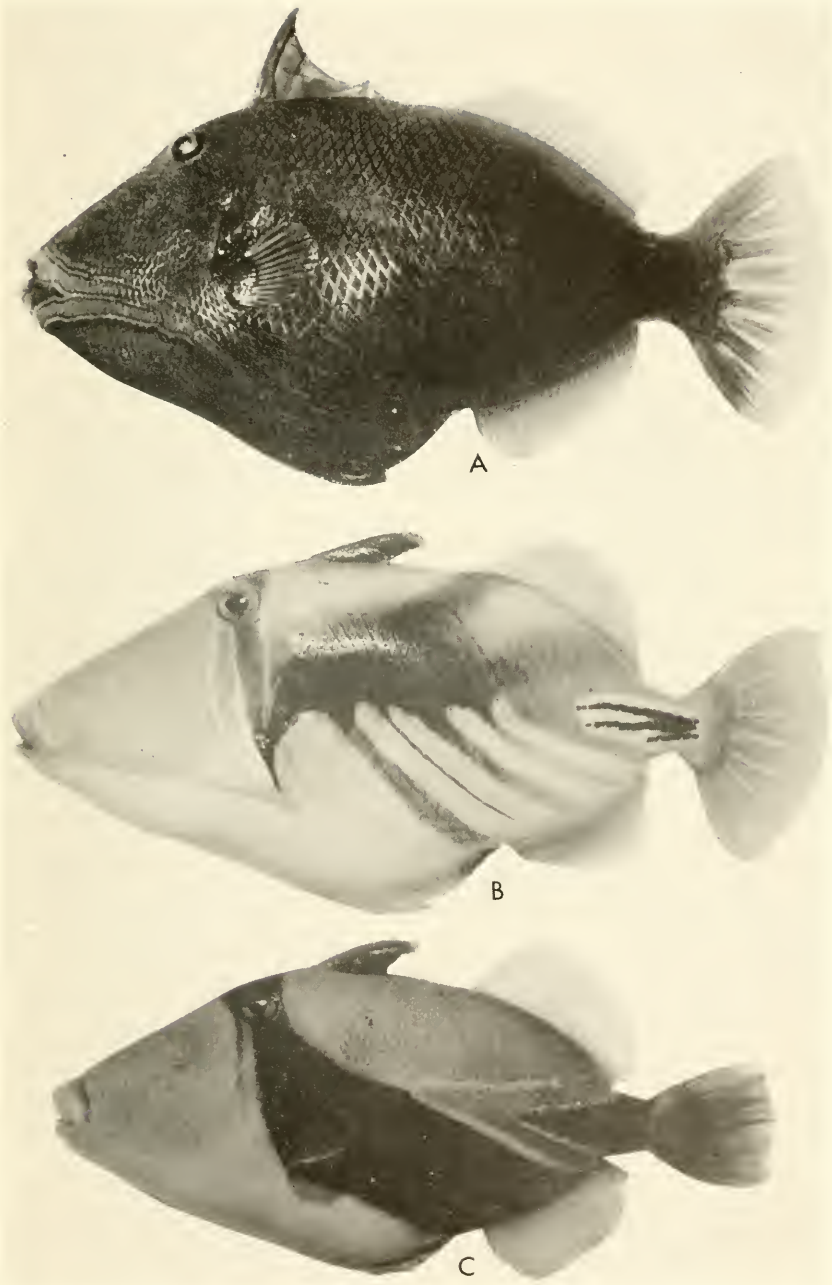
Sufflamen chrysoptera (Bloch and Schneider), drawing by T. H. Richard, from files of the division of fishes.



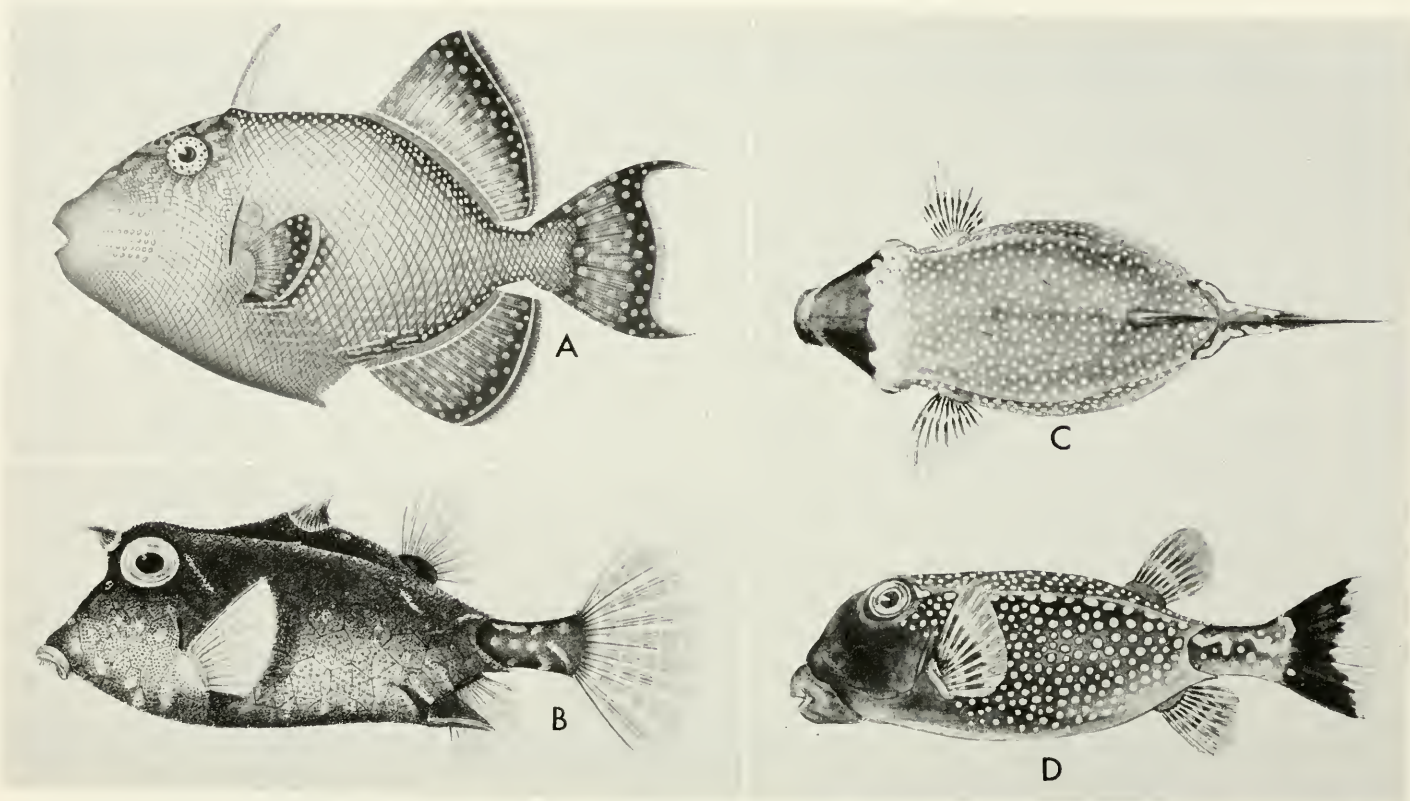
A, *Canthidermis senticosus* (Richardson), after Richardson; B, *Sufflamen bursa* Bloch and Schneider, after Bleeker; C, *S. capistratus* (Shaw), after Bleeker.



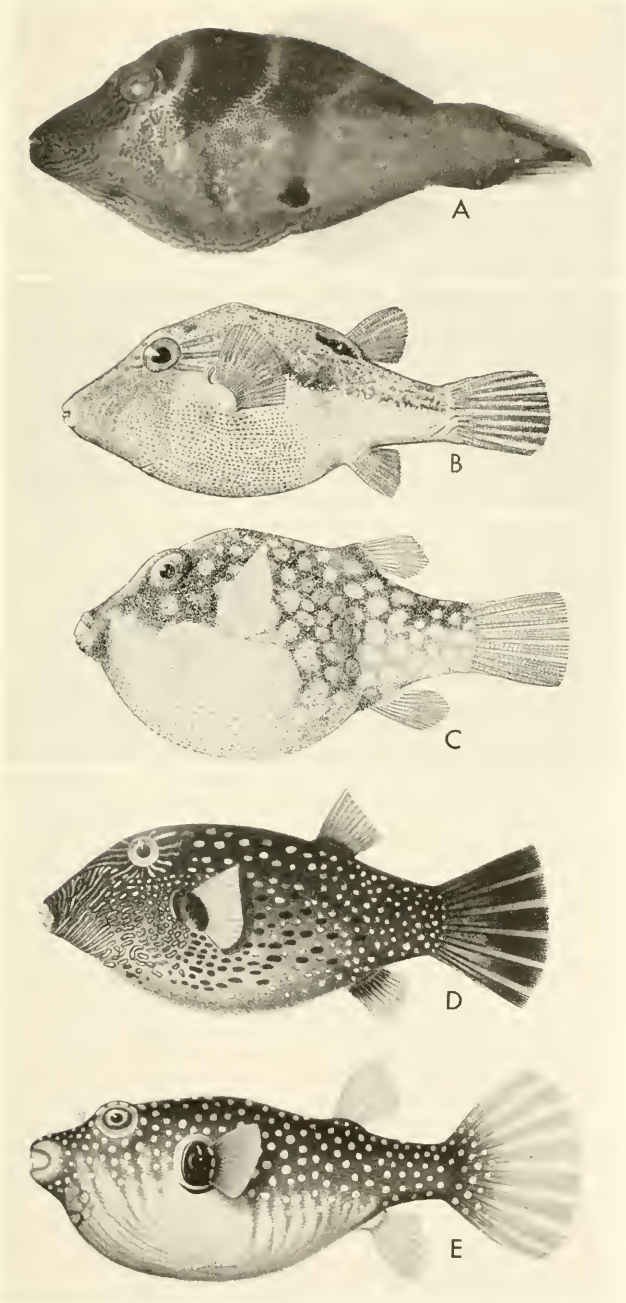
Balistoides viridescens (Bloch and Schneider), a drawing by T. H. Richard, from files of the division of fishes.



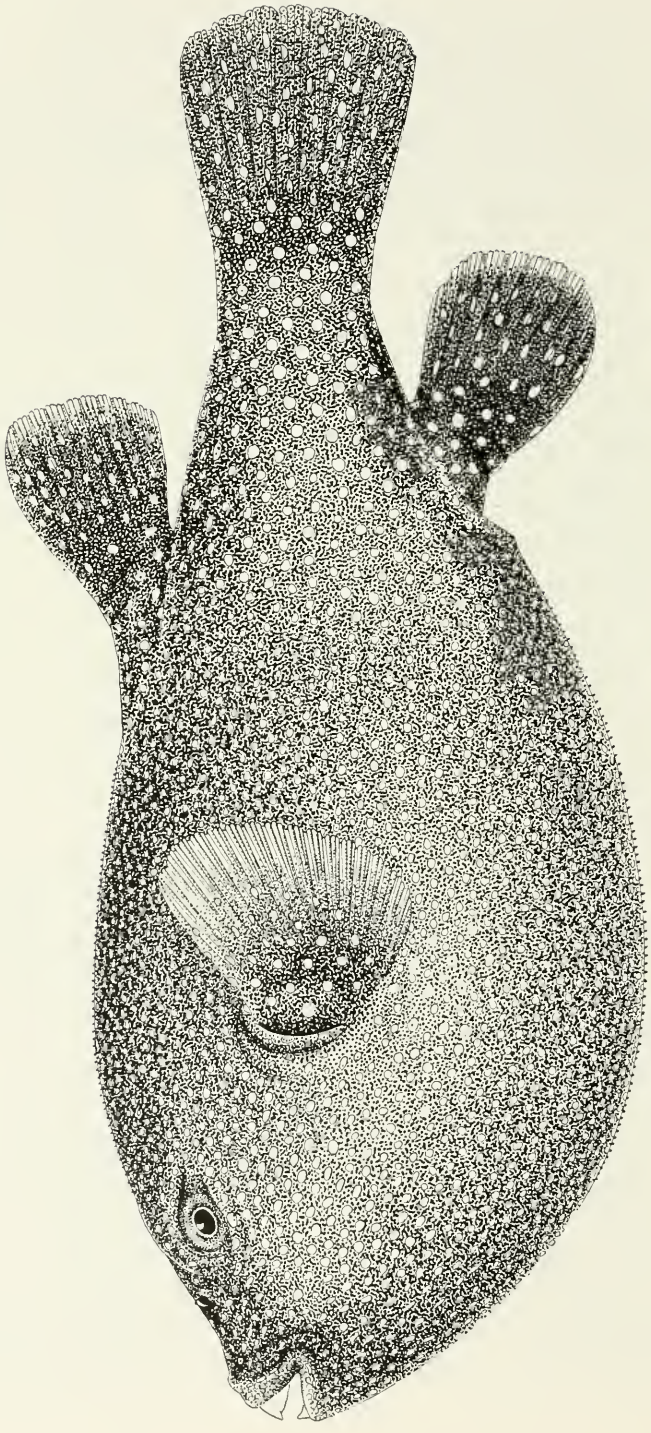
A, *Balistapus undulatus* (Mungo Park); B, *Rhinecanthus aculeatus* (Linnaeus); C, *R. rectangulus* (Bloch and Schneider); all photographs from Kodachromes taken at Bikini.



A, *Pseudobalistes fuscus* (Bloch and Schneider), after Günther; B, *Lactoria fornasina* (Bianconi), after Bleeker; C, D, *Ostracion meleagris* Shaw, photograph of a color drawing in the *Albatross* Philippine Collection.

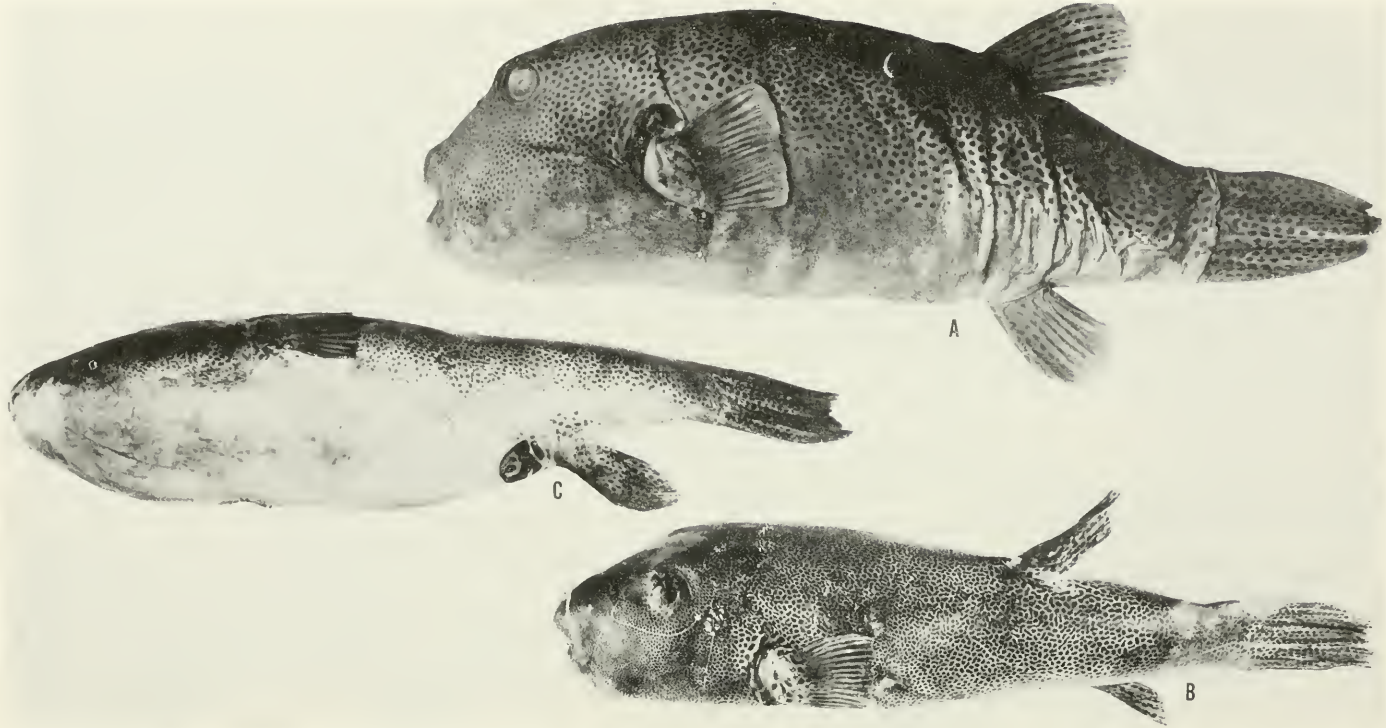


A, *Paraluteres prionurus* (Bleeker), USNM 145474, adult, from the Philippines; B, *Canthigaster bennetti* (Bleeker), after Kendall and Goldsborough; C, *C. jactator* (Jenkins), after Jenkins; D, *C. amboinensis* (Bleeker), after Bleeker; E, *Arothron hispidus* (Linnaeus), after Günther.

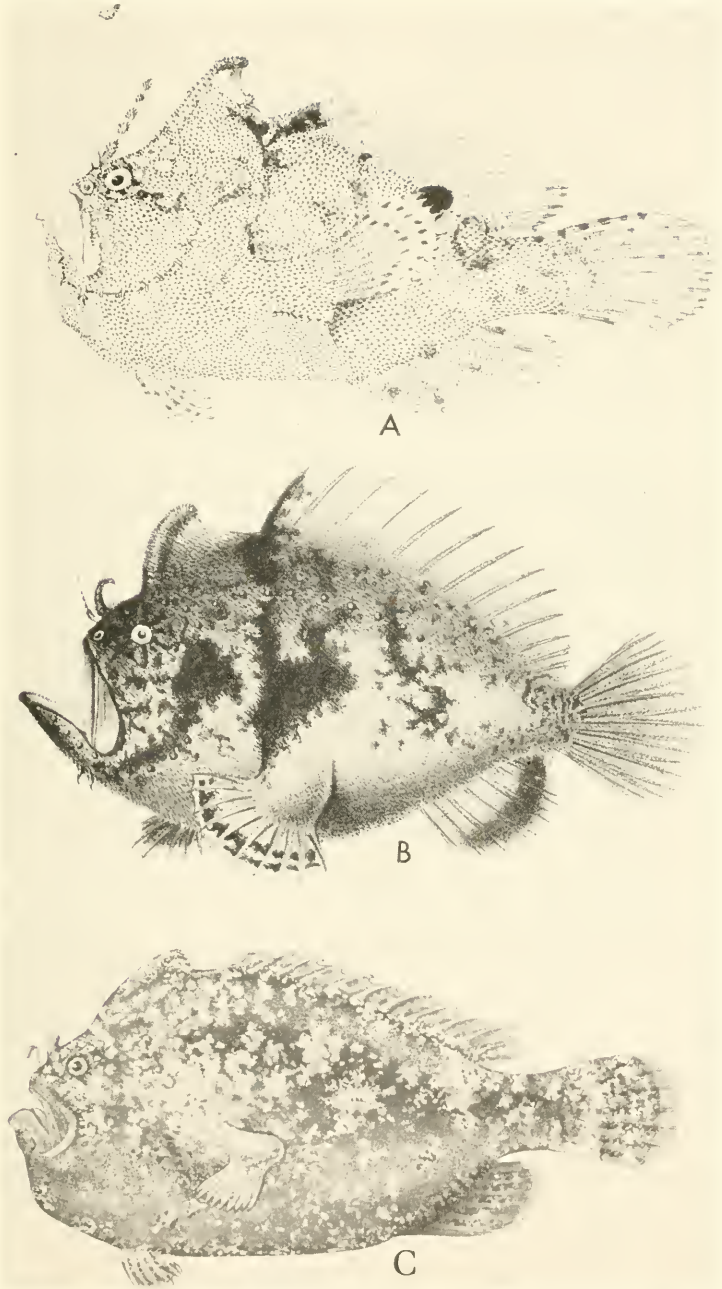


Arothron meleagris (Lacepède), after Jordan and Snyder.

A, *Ostracion cubicus* (Linnaeus); B, *Canthigaster solandri* (Richardson); C, *Diodon hystrix* Linnaeus; A, B, C, photographs from Kodachromes taken at Bikini; D, *Balistoides niger* (Bonnaterre), after Bleeker.

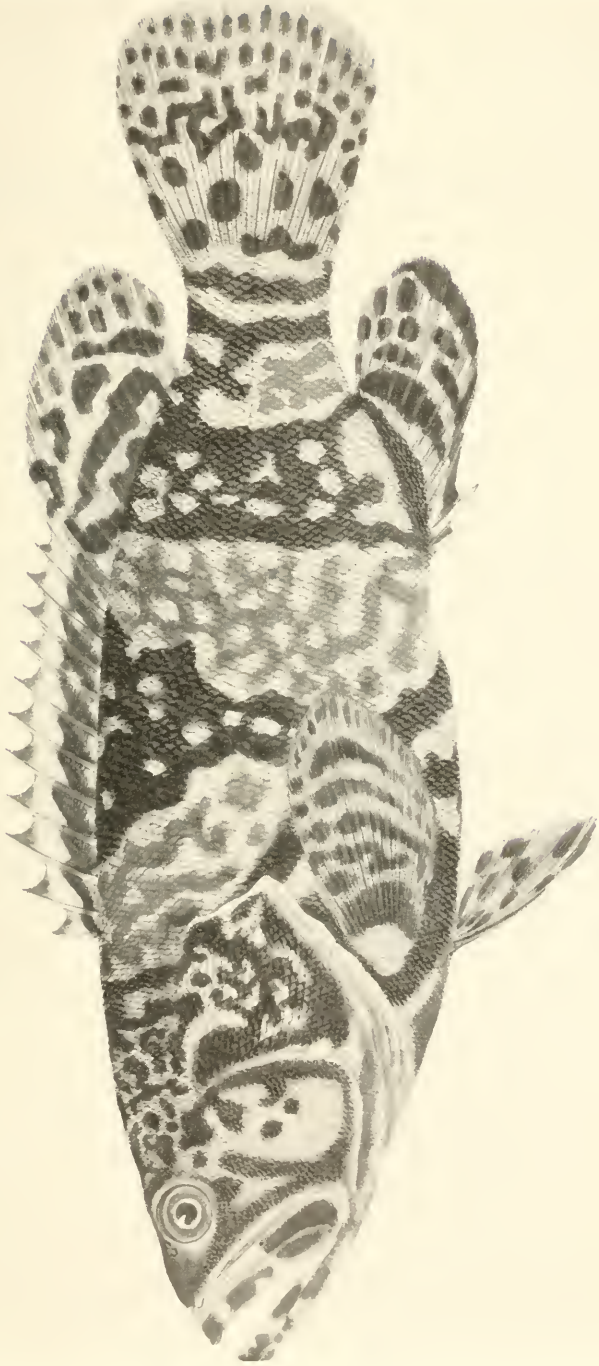


A, B, C, *Arothron alboreticulatus* (Tanaka); A, USNM 140772, female from Bikini Atoll; B, C, male, photograph through the courtesy of Dr. Bruce W. Halstead.



A, *Trichophryne rosaceus* (Smith and Radcliffe), drawing of holotype USNM 70266, from the Philippines; B, *Antennarius coccineus* (Lesson), after Bleeker; C, *A. altipinnis* Smith and Radcliffe, photograph of color drawing, USNM 150939. from *Albatross* Philippine Collection.

Promicrops lanceolatus (Bloch) from Eniwetok Atoll. A, a 414 pound specimen caught by Lowell Kupau; B, USNM 164448, a 337½ pound specimen caught by Masonori Nishi; C, a 471 pound specimen, 7 feet 7 inches, total length, caught by Robert Schook and Pitts Jayner.



Promiceros lanceolatus (Bloch), photograph of color drawing of an immature specimen in the *Albatross* Philippine Collection.

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